DOCUMENT RESUME

ED 275 686 SP 028 335

AUTHOR Peck, Leilani B.
TITLE The Nutrient Connection. Nutrition Comes Alive. Level 5. Nutrition Educator's Guide and Work Sheets, Information Sheets, Puzzles, Letter to Parents. Revised Edition.
INSTITUTION State Univ. of New York, Ithaca. Nutritional Sciences Div. at Cornell Univ.
SPONS AGENCY New York State Dept. of Health, Albany.
PUB DATE 86
NOTE 178p.; For related documents, see SP 028 330-336.
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF01/PC08 Plus Postage.
DESCRIPTORS Dietetics; *Eating Habits; Food Standards; *Grade 5; Human Body; Intermediate Grades; Natural Resources; *Nutrition Instruction; Physical Health; Self Care Skills; Student Motivation

ABSTRACT

This guide offers a nutrition education program for students in Kindergarten through Grade 6. Activities span all grades as well as activities for the specific level. Nutrition education objectives are stated for each grade level: (1) grade four--students will explore how to balance food intake and energy output for overall health and physical fitness; (2) grade five--students will be motivated to eat nutritious foods because they understand why the human body needs certain nutrients to function; and (3) grade six--students will become motivated to conserve food and food-related resources. An explanation is given of what the students should understand about the objective for each level. Activities for Grade 5 help students to: (1) establish that all living organisms are made of cells; (2) focus on the different nutrients human cells need and why they need them; and (3) explore how those nutrients get from food to the cells. A supplement to this guide contains worksheets, a letter for parents, puzzles, and recipes. A Spanish translation of the letter for parents is provided. (JD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

BEST COPY AVAILABLE

The Nutrient Connection

ED275686

NUTRITION COMES ALIVE

Level 5

Nutrition Educator's Guide
New York State
Revised Edition

SP028 335

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

L. Gardner

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Nutrition Comes Alive

Level 5
The Nutrient Connection

Nutrition Educator's Guide

A Revision by
Leilani B. Peck

Based on materials developed by Martha Plass

Division of Nutritional Sciences, a division of the New York State College of Human Ecology and the New York State College of Agriculture and Life Sciences, Cornell University, Ithaca, New York 14853. 1986.

THE UNIVERSITY OF THE STATE OF NEW YORK

Regents of The University (with years when terms expire)

1987	Martin C. Barell, Chancellor, B.A., I.A., LL.B., LL.D.	Muttontown
1987	R. Carlos Carballada, Vice Chancellor, B.S., L.H.D., D.Sc.	Rochester
1986	Kenneth B. Clark, A.B., M.S., Ph.D., LL.D., L.H.D., D.Sc.	Hastings on Hudson
1988	Willard A. Genrich, LL.B., L.H.D., LL.D., Litt.D., D.C.S., D.C.L., Sc.D.	Buffalo
1989	Emlyn I. Griffith, A.B., J.D.	Rome
1991	Jorge L. Batista, B.A., J.D., LL.D.	Bronx
1986	Laura Bradley Chodos, B.A., M.A.	Vischer Ferry
1991	Louise P. Matteoni, B.A., M.A., Ph.D.	Bayside
1988	J. Edward Meyer, B.A., LL.B., L.H.D.	Chappaqua
1988	Floyd S. Linton, A.B., M.A., M.P.A., D.C.L., LL.D.	Miller Place
1988	Salvatore J. Sclafani, B.S., M.D.	Staten Island
1989	Mimi Lieber, B.A., M.A.	Manhattan
1992	Shirley C. Brown, B.A., M.A., Ph.D.	Albany
1990	Norma Gluck, B.A., M.S.W., LL.D.	Manhattan
1990	Thomas R. Frey, A.B., LL.B.	Rochester
1990	James W. McCabe, Sr., A.B., M.A.	Johnson City

President of The University and Commissioner of Education
Gordon M. Ambach

Executive Deputy Commissioner of Education
Robert J. Maurer

Deputy Commissioner for Elementary, Secondary, and Continuing Education
Gerald L. Freeborne

Director, Division of Pupil Health and Fitness
Michael C. Willie

Assistant Commissioner for ESC Education Planning and Support Services
John J. Murphy

Director, Division for Program Development
Edward T. Lalor

Chief, Bureau of Curriculum Development
Dorothy M. Foley

Contents

Acknowledgments	5
Foreword: Developing Thinking Skills	7
Preface: Why Nutrition Education	9
Overview of Nutrition Education, Grades 4–6	11
Nutrition Comes Alive: A Practical Classroom Tool	13
Some Key Nutrition Issues	17
Sugar	17
Dental Health	17
Fats	17
Sodium	18
Iron-Deficiency Anemia	18
Calcium Concern	19
Obesity	19
Energy Balance	20
Snacks—A Nutritional Plus or Minus?	21
Fiber	21
Children and Food Advertisements	22
Nutrition Educator's Guide	23
Using *The Nutrient Connection*	25
Section 1: Think of Yourself as Cells	33
Section 2: Nutrients: The Lifeblood of Cells	45
Section 3: Your Amazing Food Tube	85
Appendix	107

Acknowledgments

The authors are indebted to the many individuals who contributed their time and talents to the revision of **Nutrition Comes Alive,** Levels 4 to 6. This revision is based on **Nutrition Comes Alive** written by Martha Plass (Levels 4 and 5) and Tracy Farrell (Level 6) in 1980.

Special thanks are extended to the elementary school teachers who reviewed the materials at various stages of development. Their comments helped to assure that the activities were appropriate for the grade level and integrated with other classroom subjects. The following teachers in Ithaca, New York, gave generously of their time: Gail Shaw, fourth grade, Belle Sherman Elementary School; Nancy Corbith, fourth grade, South Hill Elementary School; Rebecca Godin and Andrew Yale, fifth grade, Central Elementary School; Rebecca Lash, science, Ithaca City Elementary Schools; and Cortland Bell, sixth grade math and social studies, Dewitt Middle School.

An additional thank you goes to Ruth Davis, Supervisor, Center for the Expressive Arts, Ithaca Youth Bureau; Barbara Fry, former Division of Nutritional Sciences Extension Associate; and Deborah Levin, President, Science Discovery Center of Tompkins County, for reviewing manuscripts and offering valuable input.

Valuable information for the sixth grade level was received from David Pimentel, Department of Entomology, Cornell University; Charlotte Bruce, Department of Poultry and Avian Sciences, Cornell University; William Rathje, Department of Anthropology, University of Arizona; Stephen Sloan, New York State Senate; Wayne Gall, Tifft Farm Nature Preserve; Bruce Cain, Babcock and Wilcox; and Marian Hovencamp, Sea Grant Program, Cornell University.

Extensive conversations with Dr. Isobel Contento, Teachers College, Columbia University, and Dr. Lorraine Shafer, Executive Director, Dairy, Food & Nutrition Council, helped to redefine the focus of the materials by expanding the initial concepts and objectives of **Nutrition Comes Alive.** Both encouraged the development of activities that would foster thinking skills.

Dr. Contento provided extensive guidance for development of evaluation tools. Her knowledge and enthusiasm helped to assure that the activities reflect contemporary nutrition issues.

Many faculty in the Division of Nutritional Sciences provided invaluable suggestions during development of specific activities. We are particularly indebted to Dr. Christine Olson, Marcia Pimentel, Elise West, Patricia Thonney, and Christina Stark for their review.

A special thank you is extended to Margarita Morales, Cornell Cooperative Extension, New York City, for translating the letters to parents into Spanish.

The creative skill of the staff of Cornell Media Services enabled the educational materials to be transformed into attractive publications. The consistency and dedication of Trudie Calvert, editor, helped immensely in facilitating the production of the materials. Linda Haylor and Lorraine Heasley, designers, Don Albern, photographer, and Carlton Ryan and Jim Powers, illustrators, helped transform the educational materials into attractive publications. Marilyn Kelly served as the project coordinator.

Without the convictions and support of Matilda Cuomo, the First Lady of New York State, this project would not have been possible. She realized a critical need for teaching all children in New York State about nutrition and health. As a former elementary school teacher, Mrs. Cuomo is well acquainted with the needs of children and their parents.

We are grateful to Commissioner David Axelrod, New York State Department of Health, and Commissioner Gordon Ambach, New York State Department of Education, for their support of the project.

Martha C. Mapes
Coordinator, K–6 Revision
Division of Nutritional Sciences

Foreword

Why Nutrition Education

Our diets are shaped early in our lives by emotional, cultural, and social forces, as well as by the availability of certain foods. Traditions, food habits of parents and friends, and food advertising are some factors that influence American diets. Bombarded by numerous options, children should not be expected automatically to select nutritious foods. They must learn how to make nutritious choices from the array of foods available.

The ultimate goal of nutrition education is to provide knowledge and to foster skills that will promote nutritionally sound eating practices, which in turn contribute to an individual's nutritional well-being and overall health. Nutrition education should begin when children are young and in the process of developing their eating habits. Early positive experiences with nutritious foods help create a foundation for lifelong eating habits, nutritional awareness, and attitudes that facilitate good health.

Preface

Developing Thinking Skills

For children to develop good habits for nutritional well-being, we must help them learn to make intelligent food choices. Making intelligent choices depends on their ability to analyze and evaluate foods within the context of their world, which includes fast-food restaurants, vending machines, and convenience foods. Rather than ignore the influence of such modern-day phenomena, we must teach children to evaluate the foods available from such sources so they can make appropriate selections. As stated by Isobel Contento, Teachers College, Columbia University:

> Today's consumer or learner needs, on the cognitive level, to know how to select from the vast array of foods in the average supermarket those foods he or she needs for optimal health in today's context. He or she also needs to know how to be discriminating about dietary advice that comes, sought and unsought, from a variety of unequally reliable sources such as popular books, advertising, packaging labels, newspapers, and materials from food industry sources or "health" food stores.
>
> On an affective level, the learner needs to learn self restraint—particularly in light of the sedentary life-styles of most Americans, and to develop attitudes toward food selection that are conducive to long-term health.*

Developing the thinking skills of our students seems the most effective way to proceed. If we use practical examples to help students sort out the choices available and identify various nutritional options, we are helping them face this complex world of food and eating. Therefore it would seem more important for students to be able to differentiate between opinion and fact when viewing advertisements than to be able to recite the nutrients in a given food. It may be more important for them to be able to search out and decipher the key nutritional information on a label than to name food groups important to health. If overnutrition is a problem involving excess fat, sugar, salt, or total calories, students need to be able to think about how to make modifications in food choices and ingredients within their own family and cultural traditions.

In other words, the focus of teaching should shift from transferring information to the student to processing information by the student; at least, we should strive for a better balance. Teachers can help provide practical situations so students can practice using their thinking skills to take increasing personal responsibility for their food choices. This curriculum guide is offered as a way to help make this goal possible.

*Isobel Contento, "Thinking about Nutrition Education: What to Teach, How to Teach It, and What to Measure," ***Teachers College Record*** 81 (Summer 1980): 422–23.

Overview of Nutrition Education, Grades 4–6

For each grade level one major nutrition objective is supported by several understandings. The suggested activities and work sheets are intended to help students achieve the understandings and objectives.

Grade Level	Objectives/Understandings
Grade 4	Objective: Students will explore how to balance food intake and energy output for overall health and physical fitness. Understandings: 1. Energy is needed for all life processes. 2. Three nutrients in food provide our bodies with energy for daily living and activity. 3. Changes in eating patterns and exercise levels resulting from technological changes affect a person's ability to maintain energy balance.
Grade 5	Objective: Students will be motivated to eat nutritious foods because they understand why the human body needs certain nutrients to function. Understandings: 1. Human beings, like all living things, are composed of microscopic cells. 2. All cells need nutrients for energy, growth, maintenance, and repair, and these nutrients come from food. 3. As food is digested by the body, nutrients are released and carried by the blood to the waiting cells.
Grade 6	Objective: Students will become motivated to conserve food and food-related resources. Understandings: 1. Food is wasted at home, in school, and throughout the community. 2. Much energy is required to produce, process, package, transport, and prepare food. 3. Sensible use of food and food-related resources can help protect our environment.

Nutrition Comes Alive

A Practical Classroom Tool

Nutrition Comes Alive is a nutrition education program developed by the Division of Nutritional Sciences, Cornell University, for elementary school students in grades K through 6. The guide for each grade level contains information relevant to the entire age span as well as activities for the specific level. The material for each grade level is intended to help you provide students with a multitude of learning opportunities. The activities, designed to stimulate student interest, are presented in an appealing, easy-to-use format. Special features of the guides are detailed below.

Integrates Activities

A key feature of the materials is that they may by integrated with other established academic subjects. Nutrition does not have to be taught as an isolated subject. It is a recognized part of most science, health, and social studies textbooks. The upper right-hand corner of each activity sheet indicates the subject area into which the activities best fit, for example, language arts, math, social studies, science, music and art, or health and fitness. Check through the activity sheets before planning your schedule so you will know what activities best integrate with other subjects.

Focuses on Today's Concerns

With changes in lifestyles and eating patterns over the past fifty years, Americans are more likely to be affected by dietary excesses than by deficiencies.To help children make wise food choices within the context of our modern society, nutrition education must include current nutrition-related health concerns. Consequently, the material in the guides reflects such contemporary issues as the selection of nutritious snacks, the importance of physical activity for fitness, the desirability of limiting dietary intake of fat, sugar, salt, and calories, and the need to reduce the waste of food and food-related resources to protect our environment.

Provides Flexibility

The guides encourage flexibility and creativity in the classroom. They are not a prescription for teaching. Instead, a wide range of possible activities is presented so that you can select and structure learning experiences to meet the needs of your students. You may schedule nutrition education activities throughout the school year or introduce them as units.

Promotes Active Learning

The materials engage students in active learning. Such "hands-on" activities as testing lung capacity, constructing a three-dimensional food tube, creating a mini-landfill, practicing first aid techniques, and probing into food waste habits in the school, home, and community all stimulate learning by directly involving students.

Participating in these activities gives students a chance to think, feel, and act. The activities for grades 4 through 6 foster critical thinking and challenge students to investigate ideas ranging from the mystery of microscopic cells to considering environmental problems concerning energy.

Includes Motivators

Special motivators such as science experiments, puzzles, crafting an apple head doll, improvisations, and tasting new foods entice students to learn about nutrition. These exciting activities will appeal to students on both affective and cognitive levels.

Evaluates Learning

Like other components of the school curriculum, nutrition education must be evaluated to determine whether the desired outcomes have been produced. It is not easy to evaluate whether the goal of promoting behavior that fosters good health has been achieved. How students apply knowledge to nutrition and health-related issues is even more important than their increase in knowledge. Therefore, whenever possible, the evaluation should include ways to measure changes in underlying attitudes and in behavior. To facilitate this evaluation, the teaching materials in the nutrition education guides provide various tools for monitoring students' nutrition learning.

Observation: Observing students in the classroom enables you to evaluate changes in their behavior. For example, are students less likely to throw away nutritious foods during the lunch hour after they have studied food waste? Do individuals gravitate to the science materials and seem curious about exploring them? Are students eager to use their math skills to figure how many Calories are provided by the protein, fat, and carbohydrate in a given food?

Verbal Wrap-Up: Students should summarize in their own words what they learned from a particular lesson. Can they explain the importance of food energy and why too much food energy may be as much of a problem as too little? Can they tell you why exercise might be a key to health? After learning about the chemicals in food can they discuss the pros and cons of using preservatives or artificial sweeteners? Such a wrap-up gives students a sense of accomplishment and helps them remember key points.

Application of Learning: You can ask students to apply their knowledge or skills in new situations. After learning to read labels, they could be asked to evaluate several products and select the food lowest in fat or the cereal with the least sugar. Can they use their class knowledge to plan a bag lunch, a class campout, or snacks for younger children? Do they demonstrate ability to use the apparatus and keep careful records while doing science activities?

Repetition: Repeating certain classroom activities or work sheets will show whether students have changed their attitudes or values about particular issues. After studying food waste, do students indicate any changes in attitude about conservation of food and food-related resources? After participating in the mock congressional hearing activity, are students able to separate facts and opinions about sugar?

Parent Feedback: By participating in conferences, parents can provide additional evaluation information. Do parents report that their children are more conscious of the need for active exercise?

Have the children started to read labels or take more interest in what they eat at meals? After using dental disclosing tablets in class, are the children more careful about brushing their teeth? Are children more conscious of poisons in the home and have they posted the poison control number near the telephone? Have they asked where local landfills are located? Such informal information can help you judge whether the nutrition program had a desirable effect.

Encourages Parent Involvement

New ideas in any subject are always learned better if they are reinforced in the "real world." Home and family are important parts of a child's world. Parents have a strong interest in their children's health and growth, and parents also control what foods are available in the home. By working together, parents and teachers can double their impact on children's eating practices.

You can encourage parents to participate in many different classroom activities. For example, cooking activities and science experiments usually run more smoothly when an extra adult helps. Or a parent with special expertise might talk to the class or demonstrate a skill. Parents can also be invited to attend open houses or special events or to go on class trips.

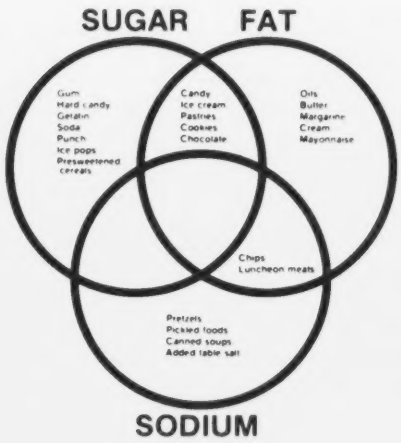
Another way to involve parents is by making a special effort to let them know what is happening in the classroom. You can share information about your class nutrition projects, and students can take home their work sheets, recipes, snack information, and letters that are included in the units.

Encourages Food-Service Involvement

The food-service personnel in your school may assist you with different food-related activities. They may be able to provide ingredients, equipment, utensils, and advice about foods and cooking safety. If you want any special help from food-service personnel, be sure to plan ahead so you can ask them well in advance of the time you need their help.

Ask your food-service staff to give the class a tour of the kitchen, or ask whether a class cooking activity could be done in the kitchen. Be sure to involve your food-service manager in your planning for a food waste study at school so it can be a positive experience for everyone. Cooperation between the classroom and cafeteria can maximize their impact on children's food habits.

Some Key Nutrition Issues



Sugar

Sugars are natural components of some foods. Fruits and some vegetables contain sugars, along with important vitamins, minerals, and fiber. Unlike fruits and vegetables, however, many food products contain large amounts of added sugar (sucrose, dextrose, honey, fructose) and contribute little more than kilocalories. When these "empty-calorie" foods and beverages replace more nutritious choices, getting enough nutrients without too many calories may be a problem. Even the increasing use of artificial sweeteners does not solve the problem of soft drinks replacing a more nutritious choice such as milk. Foods such as sugared milk products, ice cream, custards, and puddings can be considered "good" in moderation because they contain protein and calcium. But eating too many sugary products may contribute to obesity and is a major factor in tooth decay.

Dental Health

Not only are dental problems widespread in the United States, but professional dental care is expensive. Therefore it is important to begin good diet and health habits early in life.

Sugar (sucrose) is the preferred food of cavity-causing oral bacteria. When sugar is available, the bacteria eat it, forming acid. The acid weakens the tooth structure and promotes tooth decay. More critical than the amount of sugar ingested at any one time are the frequency and duration that sugar is available to oral bacteria.

Sugary snacks are of particular concern because they increase the frequency of exposure to sugar and may also increase the duration of exposure. For example, soft drinks that are sipped and sticky candies that adhere to the tooth surface keep sugar available to oral bacteria for extended periods of time, especially if they are eaten as snacks. When sweets are eaten with meals, other foods tend to buffer the acid formed and also assist in removing sugar from the teeth.

Fats

Fats provide kilocalories and essential fatty acids. But only a small amount of dietary fat supplies all the essential fatty acids. A recent concern is that Americans derive too many of their daily kilocalories from fat. Not only may this high fat consumption lead to obesity, but one class of fats appears to be an important factor in heart disease.

Studies have shown that saturated fat, found mainly in animal products, tends to contribute to heart disease, whereas unsaturated fat may not. Cholesterol, a substance found only in animal fat, has been implicated in heart disease. The primary source of unsaturated fat is safflower, sunflower, corn, and soybean oils. Coconut and palm oils contain higher amounts of saturated fats.

In light of these findings, it has been suggested that people decrease the amount of saturated fat they eat. It has been further recommended that Americans decrease their total fat consumption from the present level of about 40 percent of total calories to 30 percent.

Sodium

Hypertension or high blood pressure can be a nutrition-related health problem. Large intakes of sodium, mostly in the form of common table salt, are implicated in causing high blood pressure in susceptible persons. Lowering sodium intake and achieving reasonable weight help control hypertension.

Many advertised snack foods are very high in sodium. Potato chips, salted pretzels, and some crackers are examples of high-sodium foods. It is encouraging that new low-sodium forms of these favorite snacks are now on the market. Canned vegetables without added salt and low-salt cheeses are also now available. Cutting down on sodium is one way to build better food patterns for the future.

Iron-Deficiency Anemia

A recent survey found that 61 percent of children in the United States were receiving less than the recommended dietary allowance for iron. A continual low iron intake increases children's risk of developing iron-deficiency anemia.

Anemia is caused by a lack of dietary iron needed to form hemoglobin, a compound in the blood that carries oxygen to the cells. Symptoms of anemia include fatigue, weakness, irritability, and pallor.

Meat, poultry, dried beans, and dark green vegetables can help meet the iron requirement. In addition, unsweetened fortified cereals, whole-grain and enriched breads, and dried fruits are iron-rich foods that make appealing snacks. Because vitamin C increases the absorption of iron, citrus fruits and juices are good companions to high-iron meals and snacks.

Calcium Concern

Bone health is a key concern of both youth and adults. Interest has always focused on supplying necessary calcium and vitamin D for the formation of bone in growing infants and children. Increasing concern about osteoporosis has caused us to search out information about maintaining bone health during our mature years.

Our bones are in a state of constant flux, serving as banks in which calcium can be deposited and withdrawn. Although 99 percent of the body's calcium is in the bone, the other 1 percent circulates in the blood and is vitally important for normal nerve transmission, muscle contraction, heart function, and blood clotting. When this small but critical amount falls below a certain concentration, the bones release some of their calcium.

Low intake of calcium-rich foods during the adult years compromises bone health. Adults need calcium just as much as growing children do. Prolonged deficiency of calcium through the adult years may increase the risk of osteoporosis, a disease seen particularly in postmenopausal women and characterized by weak and fragile bones.

Since bone mass reaches its maximum when a person is about the age of 35 and declines as part of the aging process thereafter, people of all ages need to be aware of their intake of milk and such other sources of calcium as leafy green vegetables, broccoli, and fish with edible bones such as sardines, canned salmon, and fresh smelt.

Because calcium is important throughout life, students should establish habits of calcium consumption that they will follow throughout their lives.

Obesity

Obesity is a major health problem in the United States today, for both adults and children. Why is excessive weight a health concern? In adults, the prevalence of diabetes, hypertension (high blood pressure), and atherosclerosis (heart disease) increases with obesity. The concern for children is that obesity will persist into adulthood and result in health problems. Overweight or obese children also may be troubled by emotional and social problems.

What can be done? All children can be encouraged to be very active all year round. Extra attention should be paid to children with weight problems, to be sure that they find an activity they can do and enjoy—and that they continue to do it. Parents and children should learn about the problems of overeating. Good habits can be developed early. Many families are concerned about wasting food at the dinner table. Food waste, however, starts in purchasing and preparation. A good eater is a moderate eater, not a big eater.

Energy Balance

Kilocalories (energy) are needed to support life and growth. Eating too few kilocalories can result in poor health and, in children, can limit growth. Eating more kilocalories than required, however, can also result in poor health. Overweight, and especially obesity, can increase the risk of developing many health problems. The number of kilocalories that a person needs for health depends on the amount of energy that he or she uses for basic body processes and for physical activity.

Carbohydrates, proteins, fats, and alcohol are the food components that give us kilocalories. Carbohydrates, proteins, and fats are essential nutrients; alcohol is not. But there are other essential nutrients that we must eat to be healthy: minerals, vitamins, and water. Although these nutrients do not supply kilocalories, they can be found in many foods that do. Each class of nutrients is important for a variety of body functions. Therefore, the foods in our daily diet must be carefully selected to supply all the essential nutrients without exceeding our kilocalorie requirements.

Energy = Kilocalories

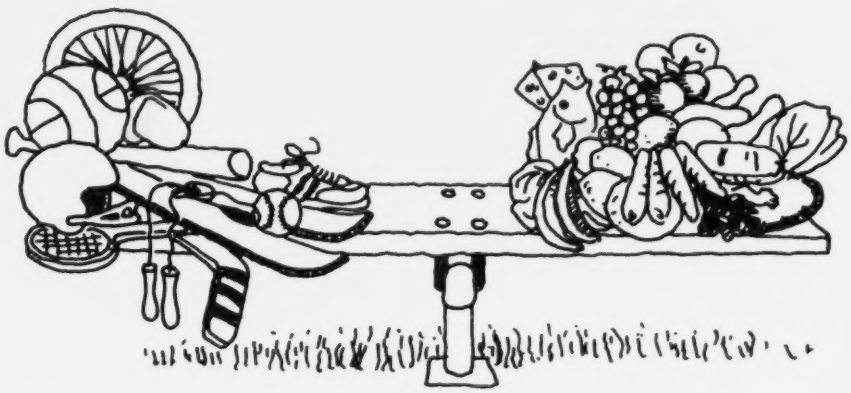
Kilocalories = Calories

The energy value of a food is expressed as a unit of heat. A kilocalorie (kcal) is the amount of heat required to raise the temperature of one kilogram of water one degree Celsius. Another way to think of this amount of energy or heat is to realize that one large apple, which contains about 100 kcal, provides enough heat to raise the temperature of slightly over four cups of water from 0 degrees C (freezing) to 100 degrees C (boiling). Four and a half cups of shredded cabbage or one tablespoon of peanut butter has a similar energy potential.

Kilocalorie (kcal) is the unit of energy we should use when we talk about the energy value of food. A kilocalorie is 1000 calories. The term *calorie* is often mistakenly used to represent the energy value of foods, but kilocalorie is the correct scientific term. For example, a glass of whole milk contains 165,000 calories. We omit the zeros and use the word *kilocalories,* with the understanding that *kilo* stands for those zeros. Another way to indicate kilocalories is to use *Calories* spelled with a capital *C.* Thus, one glass of milk has 165 kilocalories or 165 Calories. In Levels 4 to 6 of **Nutrition Comes Alive** the energy values of foods and activities are expressed as Calories rather than kilocalories.

Snacks—A Nutritional Plus or Minus?

Many people tend to think of between-meal snacks as "junk" or "empty-Calorie" food, but it is not necessarily true. The problem is that candies, soft drinks, cookies, and potato chips are often eaten exclusively for snacks in place of nutritious foods. These foods offer few nutrients but are loaded with Calories. By learning to choose snacks carefully, children can avoid overly sweet or salty and high-fat snacks in favor of more nutritious fruits, vegetables, grain products, and milk. Well-chosen snacks can make a substantial contribution to the nutritional quality of children's diets.



Fiber

The dietary fiber in our diets is not just one compound but a grouping of many complex carbohydrates found in cell walls of plants. These include cellulose, hemicellulose, and pectins as well as lignin, which is not a carbohydrate. In simple terms, dietary fiber refers to polymeric components of plant cells that your body does not digest and absorb.

Most nutritionists agree that dietary fiber is very important, but many of the benefits that have been claimed have not been proved. At the present time, the most clearly established benefit of dietary fiber is that it helps to relieve or prevent constipation. There is evidence that it is beneficial in preventing or treating diverticular disease. It has also been suggested that fiber may reduce the risk of cancer of the colon and heart disease and help control diabetes and obesity. Some of the effects may be indirect in that a diet higher in fiber will contain less fat and protein.

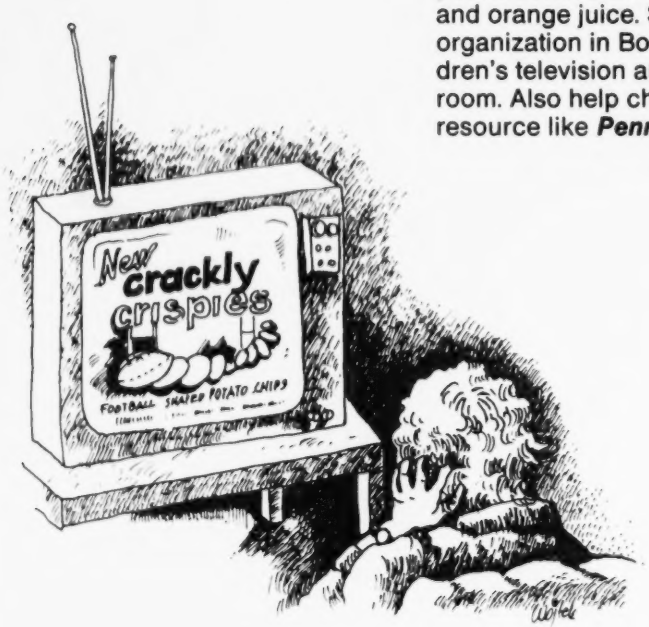
But although fiber is important in the diet, just because some is good, a lot is not necessarily better. Large doses of purified fiber may increase the excretion of some minerals, but it is unlikely that a mineral deficiency will develop if moderate amounts of fiber are eaten as part of a normal diet.

The best advice is to increase dietary fiber by eating more fresh fruits and vegetables, whole-grain bread and cereal products, beans, and nuts. With this approach you are not likely to consume excess fiber and you will get a variety of types of fiber, each of which might have a different benefit. In addition, these foods supply vitamins and minerals.

Children and Food Advertisements

Every day we are bombarded by food ads through newspapers, magazines, direct-mail ads, radio, and, of course, television. Children watch an average of 27.5 hours of television per week and more than 20,000 commercials per year. It has been estimated that 60 percent of all commercials aimed at children are for food, and, unfortunately, the majority are for nonnutritious foods and food products. With this exposure, the food ads undoubtedly have a tremendous impact on the way children think about food. It is not a simple problem to deal with, but with guidance from parents and teachers, children can learn to question what they see on television and become aware of the selling intent of ads.

Repeated positive advertising is needed to complement nutrition education. Encourage local TV affiliates to increase their use of paid and public service announcements that support healthy foods such as milk and orange juice. Support the Action for Children's Television (ACT) organization in Boston, Massachusetts, in its effort to improve children's television and consider using ACT teaching tools in the classroom. Also help children to become wise consumers by using a good resource like ***Penny Power*** magazine.



20

Nutrition Educator's Guide

Objective for Level 5

Students will be motivated to eat nutritious foods because they understand why the human body needs certain nutrients to function.

Using *The Nutrient Connection*

The Nutrient Connection introduces children to the scientific study of food. The pages that follow are filled with experiments and activities to help young scientists discover the connection between what they eat and what happens inside their bodies.

The program includes an educator's guide to classroom activities, a separate booklet of student work sheets and information sheets, and an appendix with charts, tables, and supplementary material.

Nutrition Educator's Guide

The educator's guide is divided into three sections. Section 1 establishes that all living organisms are made of cells. Section 2 focuses on the different nutrients human cells need and why they need them. Section 3 explores how those nutrients get from food to the cells.

Each section includes a brief introduction, a list of selected resources, and proposed activities suitable for the entire class, small groups, and individual students. Special care has been taken to include activities that will accommodate a wide range of interests and ability levels among fifth grade students.

The Nutrient Connection has been coordinated with the fifth grade curriculum of New York State and can be easily integrated into academic subject areas such as science, math, health, and social studies.

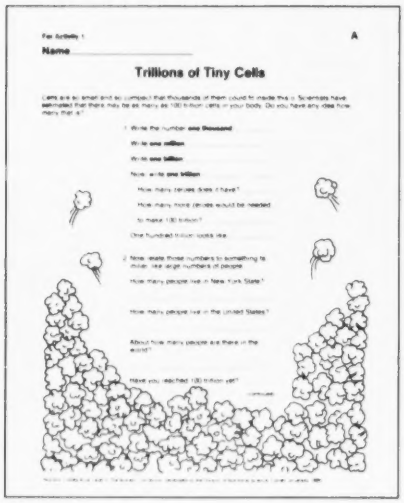
Activities

Each activity relates to a particular topic or concept. All work sheets, supplementary resources, and materials needed for each activity are listed in the advance preparation section. The materials are inexpensive and readily available at school or at home. For the few experiments that require students to wait for a certain time before checking results, plan ahead to work around other lessons or lunchtime or provide for follow-up on another day.

Extensive background information accompanies each activity so you will not have to refer to other resources. Use this information at your discretion for personal review or as content for class discussions.

Each activity concludes with suggestions for evaluating what your students have learned. Providing opportunities for the children to discuss or demonstrate their new understandings is a vital part of the **Nutrition Comes Alive** program.

Most activities also include a special feature called "Food for Thought." These questions are meant to arouse the children's natural curiosity. Encourage your students to research the answers themselves whenever possible.



Name _____

A

Trillions of Tiny Cells

Student Work Sheets

All work sheets and information sheets are coded with a letter in the upper left or right corner to make them easy to locate. The advance preparation section will alert you to copy the sheets that accompany a particular activity. In some cases, you may want each student to have a copy of the work sheet. For group exercises, several students may be able to share one copy.

Experiments

The experiments will give your students a chance to work with simple laboratory equipment and to use scientific methods and measurements. Before starting the experiments, you may want the class to read "You Are the Scientist" (Appendix 8), which emphasizes the importance of keeping a laboratory notebook and following safety precautions.

Each experiment work sheet lists all the materials needed in the order they are used. The way you set up the experiment in your class will determine the quantity of each item you will need. For example, when you use the experiment as a class demonstration, you will need smaller quantities than when you have several small groups of students doing the same experiment. Paper and pencil are listed first to remind students to record their results.

The procedure section gives step-by-step instructions for conducting the experiment. You will find it helpful to go through this section with the students before they begin to work. All procedures have been tested and should give the results described in the educator's guide. If your students do not get the expected results, have them think about what may have caused the difference. Then try the experiment again. If they continue to get different results, they may have stumbled onto a new experimental question. Encourage them to design a new procedure to investigate the new problem. This active inquiry is the essence of true experimentation. Science would never advance if scientists did not modify procedures from time to time.

Questions in the observation section of each experiment will help students understand *what* they are doing and *why*. Sometimes they will need to write down specific answers or enter data on a chart. Other times, the questions can be used to guide class discussion.

Experimentation versus Verification

Because the results of the experiments are usually described in the educator's guide, it will be tempting to tell the students exactly what they are looking for and expect them to do little more than verify those answers. Remember that in a real experiment, the conclusions are completely unknown. Children are natural experimenters. They may surprise you with the answers they are able to come up with on their own.

One scientist has suggested that every class should have two classrooms—one with a teacher and one without. At least part of the time the children would be free to explore without teacher intervention. Much of what the children would do on their own would be experimenting. Much of what they would do in the presence of a teacher would be verifying.

You will feel more comfortable allowing the children to experiment if you try the experiments yourself first. When you do, keep in mind how much fun it was for you to discover. Don't deprive your students of that thrill of discovery. Be ready to help them but not to give them all the answers.

General Resources

Resources for Teachers

Creative Food Experiences for Children. M. T. Goodwin and G. Pollen. 1974. Available from Center for Science in the Public Interest, 1755 S St. N.W., Washington, DC 20009.

This excellent resource book on nutrition and foods is for adults who care about what children eat and want to know what to do about it. The activities, games, facts, and recipes that are included make nutrition and food lively and exciting topics.

Food: Where Nutrition, Politics, and Culture Meet. D. Katz and M. T. Goodwin. 1976. Available from Center for Science in the Public Interest, 1755 S St. N.W., Washington, DC 20009.

The authors of this outstanding resource call it "an assertively unconventional food and nutrition book." The projects and activities are designed to make students want to learn about a given topic, then go on to "investigate, communicate, and effect change." Although the book is written primarily for teens, most activities can be carried out at varying levels of sophistication by students aged ten to adult.

From the Inside Out: A Guide to Food and Physical Fitness. C. Bershad and D. Bernick. 1979. Available from Learning for Life, Management Sciences for Health, Department CU2, 165 Annandale Road, Boston, MA 02130.

This book is an excellent resource for teaching the principles of physical fitness and nutrition to children. It contains information on basic nutrition concepts, fitness, anatomy, and food choices. Topics are presented in an exciting, easy-to-read format and accompanied by engaging illustrations. The text is written with "kid appeal."

How to Do a Science Project. D. Webster. New York: Franklin Watts, 1974.

This book covers three types of science projects: report, demonstration, and research. The emphasis is on procedures in a successful research project.

Jane Brody's Nutrition Book. J. Brody. New York: Bantam Books, 1982.

Written for the general public, this book provides information on a number of current issues in nutrition. The dietary guidelines, cholesterol, fiber, sugar, food additives, food labels, sodium, fad diets, and fast foods are among the many topics discussed in 27 chapters.

Nutrition: Concepts and Controversies. E. M. Hamilton, E. N. Whitney, and F. S. Sizer. 3d ed. St. Paul MN: West, 1985.

This introductory textbook presents basic nutrition concepts and current issues in an easy-to-read, personal style. Each chapter concludes with an in-depth discussion of a controversial issue such as allergies and additives, diets for athletes, and the effect of sugar on children's behavior. An extensive appendix includes a table of food composition and many additional facts.

Nutrition for Living. J. L. Christian and J. L. Greger. Menlo Park, CA: Benjamin/Cummings, 1985.

This contemporary nutrition text provides in-depth information that will be helpful as background for teachers. Discussions of subjects on the frontier of nutritional science are integrated within the text but are set off by a vertical color band running along the edge of the page. Many of the subjects relate directly to topics covered in ***The Nutrient Connection***.

Nutrition Source Book. National Dairy Council. Addresses of local offices in New York State are listed in Appendix 2.

This 40-page book is an excellent resource on nutrition, the role of nutrients, and the application of this knowledge.

The 100% Natural, Purely Organic, Cholesterol Free, Megavitamin, Low Carbohydrate Nutrition Hoax. E. M. Whelan and F. Stare. New York: Atheneum, 1983.

In appealing to caution and good sense, Whelan and Stare take the side of science to do battle with the myth-makers, food faddists, and profiteers. Dr. Whelan is executive director of the American Council on Science and Health. Dr. Stare is the founder of Harvard University's Department of Nutrition.

What's to Eat? And Other Questions Kids Ask about Food. USDA. Yearbook of Agriculture, 1979.

This yearbook is dedicated to young people. It covers the story of food from the history of eating to how foods will change in the future. One chapter is devoted to cells, nutrients, and digestion. The book is colorfully illustrated and written in a lighthearted style.

Energy: Our Food and Our Needs. Produced by Susan Travis and Barbara Fry. Revised by Susan Travis. 1984. Division of Nutritional Sciences, Cornell University. Available for sale or rent from Cornell University Audio-Visual Center, 8 Research Park, Ithaca, NY 14850.

This three-part Cornell Cooperative Extension slide set covers foods high in energy nutrients; use of carbohydrates, fat, and protein within the body; individual energy needs; effects of imbalanced intakes of carbohydrates, fat, and protein; practical application of dietary guidelines; and a reminder that alcohol provides calories but no nutrients.

Resources for Students

Good for Me! All about Food in 32 Bites. M. Burns. Boston: Little, Brown, 1978.

This book is part of the Brown Paper School series created for adults and children by a group of California teachers, writers, and artists. The group believes that learning happens only when it is wanted, that it can happen anywhere, and that is does not require fancy tools. The book contains chapters that relate to topics covered in ***The Nutrient Connection***.

Science Experiments You Can Eat. V. Cobb. Philadelphia and New York: Lippincott, 1972.

This popular book emphasizes using common foods to demonstrate scientific principles. The simple experiments require no sophisticated chemicals or equipment.

More Science Experiments You Can Eat. V. Cobb. New York: Lippincott, 1979.

In this follow-up to her first book, Cobb emphasizes using scientific principles to investigate the properties of food.

The New Food Book. M. Berger and G. Berger. New York: Crowell, 1978.

This book describes the chemistry of food, digestion and nutrition, and food production and processing. The emphasis is on new sources of food, the causes of the present food crisis, and what is being done to meet the needs of the world's increasing population.

Nutrition Education Specialists

Cornell Cooperative Extension. Addresses of local offices are listed in Appendix 1.

Adult and 4-H agents, serving as professional home economists at the county level, are part of Cornell Cooperative Extension statewide and work closely with faculty and staff in the Division of Nutritional Sciences at Cornell University to promote nutrition and health.

Youth programming includes a large 4-H youth development effort, a part of which is work with teachers in the schools. **Nutrition Comes Alive**, K–6, and **Make Up Your Mind about Alcohol**, 5–6, are two special nutrition resources developed by Cornell Cooperative Extension for school use.

Consult your local Cornell Cooperative Extension office for details about workshops and current resources.

National Dairy Council. Addresses of local offices in New York State are listed in Appendix 2.

The National Dairy Council offers many excellent nutrition education resources for the classroom. Order a copy of its current catalog to select resources to match the ability levels of your students. You will find specific reference to several of these resources in ***The Nutrient Connection***.

New York State Education Department. Bureau of Health and Drug Education and Services.

The Nutrition Education and Training Program (NET) is currently organized into three regions in New York State. Services under NET include assistance in the development of nutrition education programs and services; training workshops for administrators, teachers, and school food service staff; and development and distribution of nutrition resource materials. Addresses of regional offices are listed in Appendix 2.

Food Education Resources

New York Agriculture in the Classroom. Developed by the Department of Education, Cornell University, 1986.

In the fall of 1987 the **New York Agriculture in the Classroom** program will have curriculum materials to teach required subject matter using accurate agricultural examples. Production, processing, distribution, and retailing of food and fiber will be the focus of units in science, social studies, mathematics, and language arts. Contact your county Cornell Cooperative Extension 4-H program for information.

Note: Specific resources needed for activities in each section are listed on the back of the appropriate section dividers. You may need to order films well in advance of when they are needed.

Section 1

The Nutrient Connection

Think of Yourself as Cells

Understanding:

Human beings, like all living things, are composed of microscopic cells.

Before You Start

Why do we eat? In the strictest sense, we eat to nourish our cells. Of course, few ten-year-old children would see any connection between eating pizza and feeding a cell. In fact, they probably never thought much about what food does for their bodies or *how* it does it.

In *The Nutrient Connection*, your students will begin to explore the science of food and how it relates to their bodies. They will find out why cells need nutrients, what those nutrients are, and where the nutrients come from. They will also discover that people around the world are able to get the same nutrients from many different foods.

The activities in this first section are designed to help your students think of the human body as a community of cells. First, they will try to visualize the large number of tiny cells in their own bodies. Then they will investigate similarities and differences among cells, the process by which substances enter and leave cells, and the reasons cells need such a variety of raw materials to carry out their specialized functions in the body.

Activities	Subjects
1. You Are Trillions of Cells	Math, Social Studies
2. Cells Team Up	Science
3. Membranes Stem the Flow	Science
4. Tools of the Cell Trades	Science, Math

Resources

Blood and Guts: A Working Guide to Your Own Insides. L. Allison. Boston: Little, Brown, 1976.

Part of the Brown Paper School Series, this book includes a chapter on the cell. The author presents information in a light and entertaining style that makes the book fun as well as educational.

Cells: Building Blocks of Life. A. Silverstein and V. B. Silverstein. Englewood Cliffs, NJ: Prentice-Hall, 1969.

This introductory book explains how a cell is born, what it is made of, and how it works with trillions of other cells to make us what we are. It is designed to give the young reader an elementary understanding of the cell as the basic unit of life.

Cold-Blooded Animals. Milwaukee: Raintree, 1981.

This reference book distinguishes between cold- and warm-blooded animals. Using simple text and beautiful color illustrations, the book covers such animals as amphibians, crabs, octopuses, insects, fish, and reptiles.

The Human Body: Your Body and How It Works. R. D. Bruun and B. Bruun. New York: Random House, 1982.

Written by two medical doctors, this pictorial book covers all the regions and systems of the body including tissues, cells, and the digestive system.

Make Up Your Mind about Alcohol. Developed by the Division of Nutritional Sciences at Cornell University. Available from Audio-Visual Resource Center, 8 Research Park, Cornell University, Ithaca, NY 14850.

In this cross-age teaching program, high school students conduct three alcohol education sessions in the fifth or sixth grade classroom. The key teaching aid is a set of 56 slides.

Why You Feel Hot, Why You Feel Cold: Your Body's Temperature. J. Berry. Boston: Little, Brown, 1973.

This simply written book explains how the body regulates its temperature and what happens when humans get a fever. The author has included simple experiments to help children learn about their own bodies.

You Are Trillions of Cells

Advance Preparation

Copy work sheet A for each student.

Optional:

Collect resources containing population figures for New York State, the United States, and the world, distances around the earth's equator, from the earth to the moon, and from the earth to the sun.

Bring to class:

Package of hot dogs (optional).

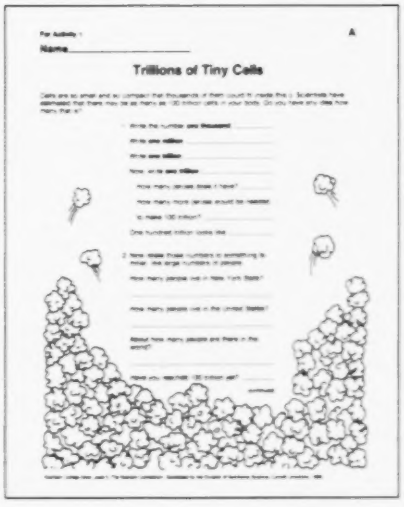
6-inch cube-shaped box.

Popcorn or styrofoam packing material.

Rigid measuring stick, 6 to 8 feet long.

100 Trillion Is a Lot of Cells

Helping children visualize the enormous number of tiny cells in their bodies presents a challenge. Simply telling them that they are made up of 100 trillion cells means very little until they try to work with numbers that size. Once the concept of trillions becomes clearer, they should be better able to imagine how tiny and how numerous their own cells are.



Trillions of Tiny Cells

The four problems on work sheet A will help you illustrate these concepts with analogies and objects that are familiar to children. The problems vary in difficulty to allow for different ability levels. They are suitable for either individual or group assignments.

Trillions of Tiny Cells

You can expand the first problem on work sheet A to illustrate exponents or powers of 10. Line the numbers up pyramid fashion on the board to clarify place values.

The second problem could incorporate library research giving students experience in using atlases and other reference books. If you do not wish to have students research population figures, use the following census data:

New York State: 18,000,000

United States: 238,000,000

The world: 4,600,000,000

For the third problem, the students will need to know the following distances:

5,280 feet in a mile

25,000 miles around the equator

240,000 miles from the earth to the moon

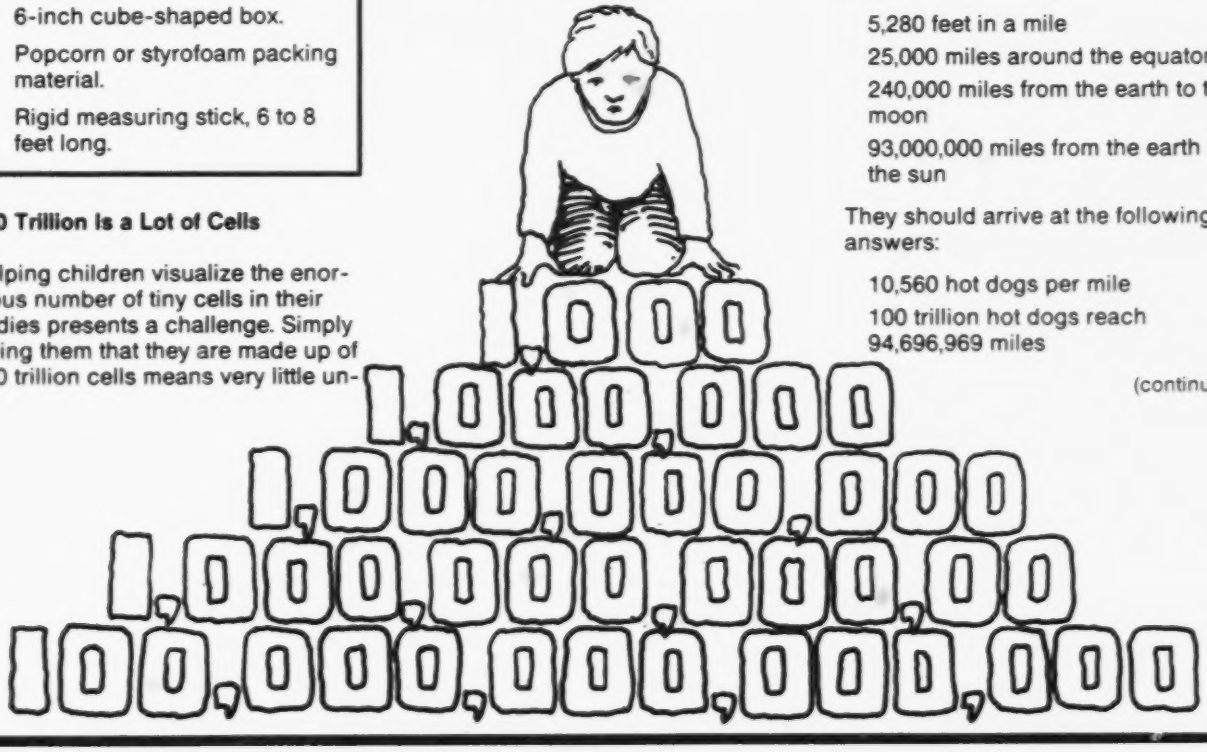
93,000,000 miles from the earth to the sun

They should arrive at the following answers:

10,560 hot dogs per mile

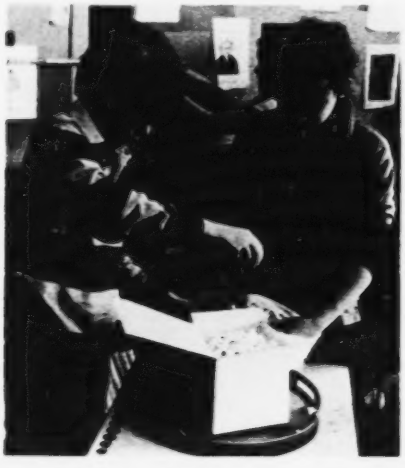
100 trillion hot dogs reach 94,696,969 miles

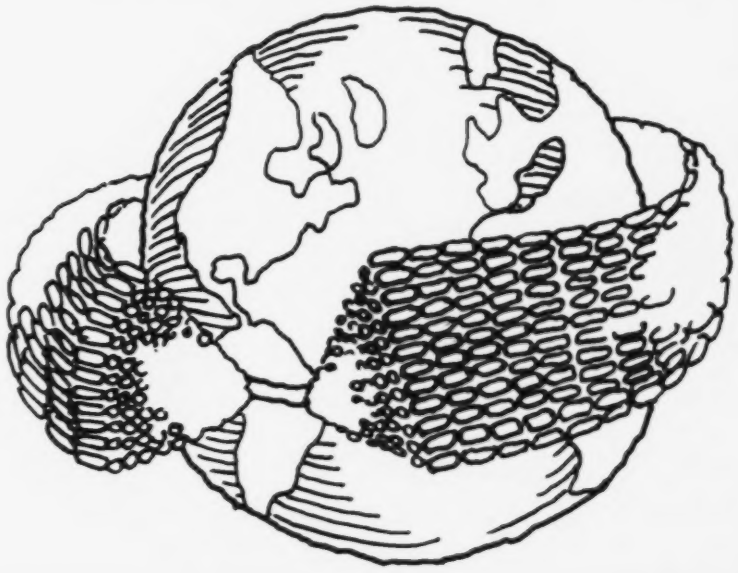
(continued)



More advanced students could measure the diameter of a hot dog and use it to figure the dimensions of a hot dog wall around the equator. For example, if the hot dogs are one inch in diameter, twelve of them side by side would measure one foot. How high would a one-foot-thick hot dog wall be? Directions for calculating the dimensions of a hot dog wall are given in the box below.

The fourth problem uses popcorn because it fills the box quickly. Styrofoam packing material will work well, too. Students may round off their numbers to hundreds to simplify the math. Be sure to observe safety precautions when measuring the height of the classroom ceiling.





To figure the dimensions of a hot dog wall, start with the circumference of the equator (25,000 miles). Twelve strings of hot dogs laid side by side would make a foot-wide band of hot dogs around the equator. Those twelve parallel strings of hot dogs would stretch a combined total of 300,000 miles (12 x 25,000 miles), so 3,168,000,000 hot dogs would be needed for the first layer of the wall (300,000 miles x 10,560 hot dogs per mile). The 100 trillion hot dogs would make 31,566 layers stacked one on top of the other (100 trillion divided by 3,168,000,000). If there are twelve layers to a foot, the wall would be 2,630 feet high (31,566 divided by 12). Because 2,630 feet is just under half a mile, *the wall would measure one foot thick by one-half mile high.* Math whizzes may point out that each layer of hot dogs has to be longer than the one before it because the diameter of the circle increases with each trip around the earth. Such complex problems are beyond the scope of elementary mathematics. The purpose of this exercise is to give students a sense of the magnitude of 100 trillion. Absolute accuracy is not critical to that understanding.

Additional Activities

More Ways to Count in Trillions

Students who want to try other ways of conceptualizing 100 trillion can do an original project or math problem, a bulletin board for the classroom, or a hall display. Encourage them to relate their projects to cells.

Evaluation

Have the class discuss work sheet A. Were such large numbers difficult to work with? In their calculations, did they come close to 100 trillion? You may wish to give a short math quiz to test your students' understanding of place values in large numbers.

32

Cells Team Up

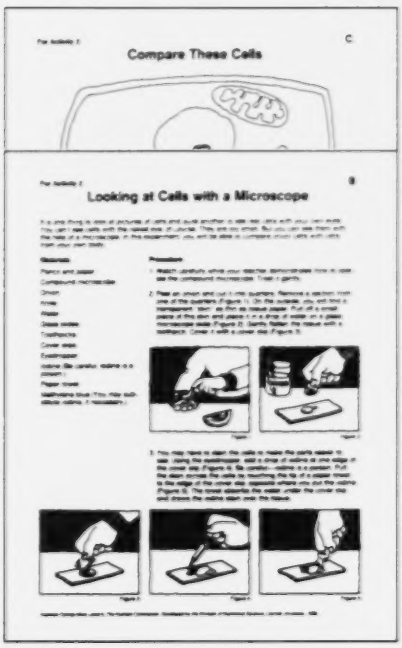
Advance Preparation

Collect a variety of tissues such as hair, fur, skin, ham bone, raw meat, fruits and vegetables (orange, tomato, celery), blood, and chicken fat.

Set up one or more compound microscopes with a selection of premounted glass slides of various cells. Familiarize yourself with the operation of the microscope.

Copy work sheet B and gather the materials listed. Methylene blue should be available from the high school biology department.

Refer to information sheet C. If desired, make copies to use in class.


Compare These Cells

Looking at Cells with a Microscope

Building a Body from Cells

Some living things are tiny, jellylike organisms with only one cell. These single-celled organisms can do everything necessary to stay alive. They take in food, create energy, get rid of wastes, and reproduce, all by themselves.

More complex organisms, such as humans, are made up of billions or even trillions of cells. In multicelled organisms, the cells divide into teams. Each team performs special jobs to keep the organism alive. Some may carry messages, others food or oxygen. Still others may provide structure or covering, remove wastes, or destroy germs and viruses. These cells are **specialized**.

Each cell team makes up a particular type of **tissue** such as nerve tissue, blood tissue, bone tissue, muscle tissue, or epithelial tissue (coverings and linings).

Several different tissues may then combine to form **organs**. One example of an organ is the stomach, which is made of muscle, nerve, and epithelial tissues.

Organs work cooperatively in **systems**. The stomach, for example, is part of the digestive system. All the systems function together as a total **organism**. The variety and interdependence among our human cells make our bodies very complex, versatile, and adaptable.

Comparing Tissues

Collect tissue samples from both plants and animals. (Suggested tissues are listed under Advance Preparation.) Have the class compare the samples.

—Do all the tissues look alike? (No.)

—Do you think all the cells in these different tissues would look alike? (No.)

Looking at Cells with a Microscope

Arrange for the class to examine cells using a compound microscope. If your students are unfamiliar with microscopes, begin by demonstrating how one operates.

Work sheet B guides the students in comparing onion cells and human

(continued)

epithelial cells (from the inside of the cheek). Go over the procedure section step by step with the class before the students attempt to work on their own.

The students may also examine other cells that have been premounted on slides or which they prepare themselves from the tissue samples you have brought to class. Encourage them to draw what they see as they view each slide. It may be more manageable to have students work in teams to prepare a single slide and then share the slides with other groups.

Comparing Cells

Select some of the cells the students have looked at in class. Draw them on the board. Discuss:

—Are the cells the same shape?
(No.)

—What parts do the different cells have in common?
(Point out structures that look the same in all cells.)

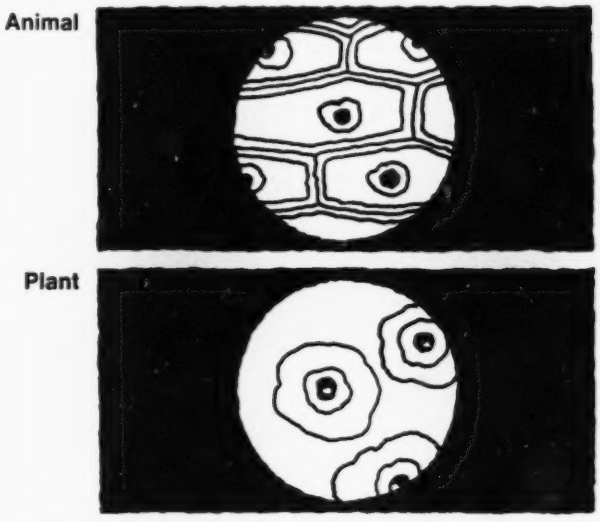
Draw a composite plant cell and a composite animal cell on the board. You may copy the composite cells on information sheet C. Label the major parts. Explain their functions as described in the box.

—What does a plant cell have that an animal cell doesn't have?
(Cell wall.)

—What does that part do for the cell?
(Provides rigidity.)

Show the class the eight sample cells on information sheet C. Find the major parts in each one. Ask the class:

—What part is the red blood cell missing that other cells have?
(The nucleus.)



—What has happened to it?
(Red blood cells are made in bone marrow and lose their nuclei before they enter circulation. Since their only function is to carry oxygen to body tissues, mature red blood cells don't need a nucleus. But without one, these cells cannot repair themselves. Therefore, they have a relatively short life span of only 120 to 130 days. Red blood cells are dying and being replaced at the rate of about 2 million per second.)

Evaluation

Draw the composite cells (see information sheet C) on the board. Number the major parts. List the names of the major parts in a column next to each drawing. Have the students match the number on the drawings with the name of the part.

Set up slides of different cells under the microscope. Ask students to identify the cells they see. Be sure to use slides that every student had a chance to see during the activity.

☞ **Food for Thought**

Some cells do not fit the usual description. Did you know that your body has a single cell that runs all the way from your big toe to the back of your head?

It is a sensory nerve cell. It has to be one long cell so it can transmit messages quickly from the toe to the brain.

Cell Membrane—The outermost membrane of the cell. It holds the cell together and decides what materials enter and leave.

Cell Wall—A rigid structure outside the cell membrane in most plant cells.

Cytoplasm—(sigh' toe plazim) The living matter within the cell. Everything in the cell moves around in the cytoplasm.

Mitochondria—(my toe kon' dree a) The "energy factories" that produce heat and energy for the cell.

Nucleus—(new' klee us) The "brain" of the cell. The nucleus contains the hereditary information that directs the cell's activities and enables it to reproduce.

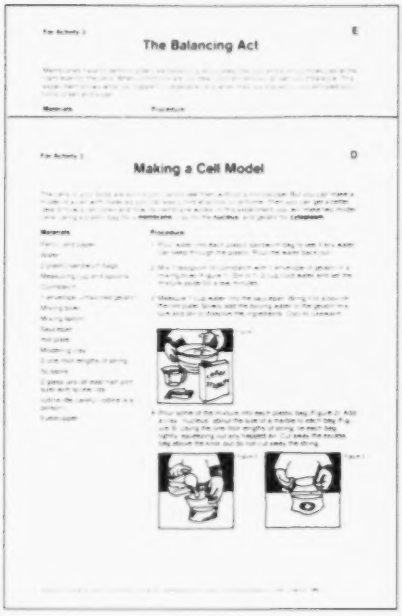
Membranes Stem the Flow

Advance Preparation

Decide whether work sheets D and E will be done as a demonstration, individual activity, or group project.

Copy work sheet D and gather the materials listed.

Copy work sheet E and gather the materials listed.



E

The Balancing Act

D

Making a Cell Model

Membranes—Gatekeepers for the Cells

The membrane around a cell serves two important purposes. First and most obvious, it holds the cell together. But it also regulates the passage of all materials into and out of the cell. That function is critical to the life of the cell. Oxygen and nutrients must get in. Wastes must pass out. And a balance must be maintained.

In this activity, students will explore how membranes work and relate what they learn to the membranes of their own cells.

Making a Model Cell Membrane

Membranes work something like strainers or filter paper. A membrane that allows only certain materials to move in and out is called a **semipermeable membrane**. **Semi** means *partly* and **permeable** means *able to be penetrated*. How cell membranes control which molecules are allowed to pass through is a very complicated matter. It is not possible to teach all of the intricacies of the membrane at this level. But it is possible to show that the cell membrane is selective.

To demonstrate that some molecules can pass through but others cannot, have the class make a cell model, following the directions on work sheet D. The cell model is a gelatin-starch mixture inside a plastic sandwich bag that is then suspended in an iodine solution. The plastic serves as the cell membrane. Although it appears impermeable, it does have invisible holes. These holes are larger than an iodine molecule but smaller than either a starch molecule or a water molecule.

When the iodine comes in contact with the starch, it changes color from brown to blue. In this case, the blue color will appear *inside* the cell (the plastic bag), indicating that the iodine molecules have entered through the membrane. Since the water outside the cell model did not turn blue, we can conclude that the starch molecules were unable to leave the cell through the membrane. (Note that there is no color change in the cell model suspended in plain water.)

After making the cell model, explain that human cell membranes work in a similar way. They play an important role in controlling the nutrients

(continued)

and other materials that pass into and out of every cell.

Keeping the Balance

If a molecule can enter through a cell's membrane, what is to prevent it from turning around and passing back out again? The cell's membrane can control this flow to keep the cell in balance. Once the class understands that cell membranes are semipermeable, you may decide to go a step further and demonstrate the balance of in-and-out flow.

To understand balance, it is important for students to know something about concentration. The more molecules of a substance that are dissolved in a solution, the more *concentrated* the solution becomes. For example, a teaspoon of salt dissolved in a cup of water is a dilute or weak salt-water solution. As more salt is added to the cup of water, the salt-water solution becomes more concentrated or stronger.

You can illustrate this point by drawing two circles five feet in diameter on the floor or playground. Put three students in one circle and nine in the other. Which circle is more concentrated? (The one holding nine.)

Water will tend to flow from the less concentrated solution to the more concentrated solution. Have three students stand inside one circle with the rest of the class crowded around them outside the circle. Where is the concentration of students greater? (Outside.) Have some students step over the line until there is about equal space around each of them. They have created a more equal concentration inside and outside the circle.

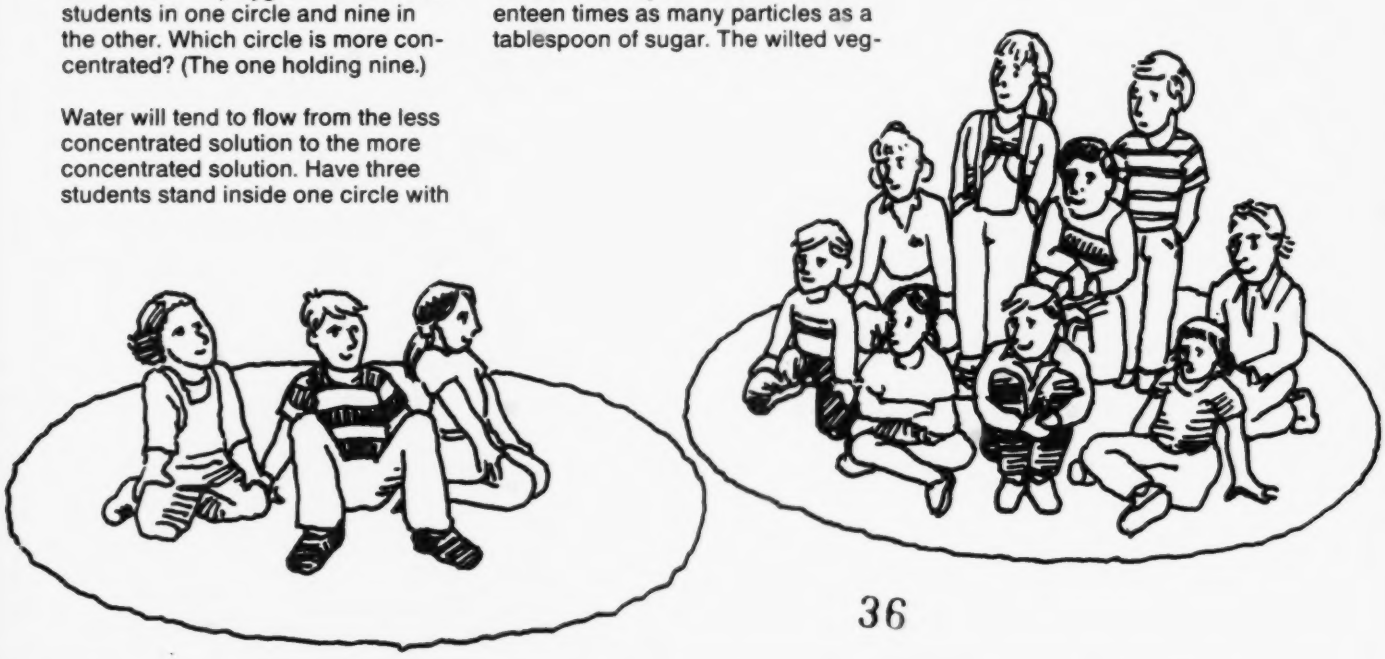
Water molecules will cross a cell membrane to balance the concentration of certain substances inside and outside the cell. Crisp vegetables such as celery, carrots, and potatoes can be used to illustrate this balance. Have the students do the exercises in work sheet E to see what happens when the vegetables are placed in plain water, salt water, and sugar water.

In plain water, the vegetable strips remain crisp. In sugar water and salt water, the vegetable strips become flexible. That is because water moves from inside the vegetable cells to the solution outside the cells, where the concentration of particles is greater. The vegetables in the salt water will be the most flexible because a tablespoon of salt has seventeen times as many particles as a tablespoon of sugar. The wilted vegetables become crisp again in plain ice water because the water quickly reenters the cells. The vegetables that are left sitting in the empty dish will lose some moisture but will not wilt as much as the ones in the salt and sugar solutions.

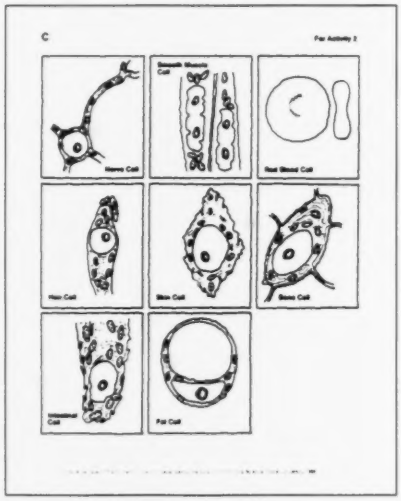
Humans do not "wilt" in exactly the same fashion as these vegetables, of course, but similar imbalances can and do occur in the body. In extreme situations, a person can become dehydrated when too much water is lost from the body through diarrhea, repeated vomiting, or excessive perspiration. There may not be enough water left to maintain the balance. If that happens, cell health may be threatened by high concentrations of potentially poisonous substances in the body.

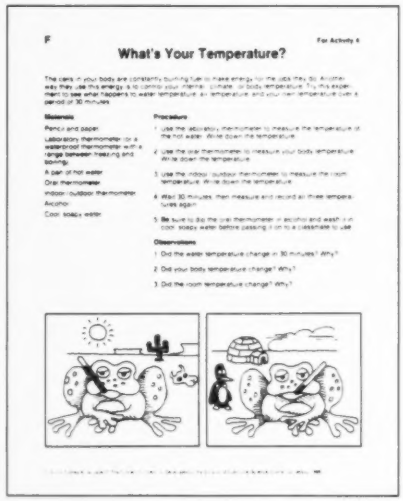
Evaluation

Repeat some of the questions in the observation sections of work sheets D and E in a class discussion or a brief written quiz.



Tools of the Cell Trades





Advance Preparation

Copy information sheet C.

Copy work sheet F and gather the materials listed.

Copy work sheet G and gather the materials listed.

Copy work sheet H and decide whether to do it as a classroom activity or a homework assignment. (Before doing the problems in class, have the students find out their weights at birth and at one year. Make up birth weights for students who do not have growth records of their own.)

Specialized Jobs Require Specialized Tools

Have the students think about the different jobs done by people in a community. Ask the class:

—Do doctors use the same tools and raw materials in their work as car mechanics do?

—Do telephone operators need the same tools as sanitation workers?

—What tools does a plumber need? A piano tuner? A filmmaker?

You could go on and on—and so could the cells in the body. Different cells require different tools and raw materials to carry out their specialized functions. Show the class the drawings of the hair, muscle, bone, fat, skin, nerve, intestinal, and red blood cells on information sheet C. These are just some of the specialized cells in the body. Ask the class:

—What are some of the specialized jobs these different cells have to do?

—Are there any jobs that most cells have in common?
(Growth, repair, reproduction.)

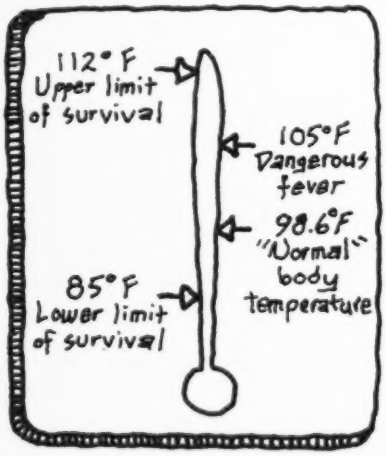
—Where will they get the supplies they need to do their jobs?
(From food.)

All Cells Need Energy

In addition to raw materials, all cells need fuel to do their jobs. That fuel also comes from food. Every cell has tiny energy factories called mitochondria that mix the fuel from food with oxygen to produce energy.

Cells also need energy to maintain their warm environments. As the fuel is "burned" inside the cells, heat is produced.

Climate control inside the body is very important. No matter what a person is doing or what the outside temperature is, the inside temperature of the body has to be maintained near 98.6 degrees Fahrenheit. The body takes care of that by constantly adjusting the rate fuel is burned inside the cells. Check this out in class by doing work sheet F. In the experiment, the students will discover that their own temperatures remain constant even though the temperature outside their bodies may change. This is true only of warm-blooded animals. Cold-blooded animals, like the frog, have no climate control so their internal temperature changes with the out-



(continued)

side temperature. When the temperature goes down, all their body processes slow down, too.

Why does the body's temperature have to be so constant? Chemical reactions are partly dependent on temperature. The thousands of chemical reactions that go on inside the body happen most efficiently at or about 98.6 degrees Fahrenheit.

The experiment described in work sheet G allows the students to test the effect of temperature on chemical reactions in a living organism. It also demonstrates the importance of a food source for cell energy production. In this case, the organism is yeast and the energy source is sugar.

The yeast mixture in glass A serves as a control because it contains no sugar. The yeast in glass B will multiply most rapidly. The chilled yeast in glass D will multiply much more slowly. Boiling kills the yeast, so nothing will happen in glass C.

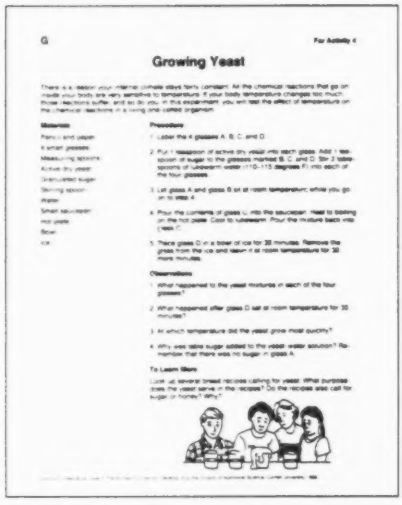
Cells Make New Cells

Cells must also be able to make new cells, or **reproduce**. When an organism is growing to maturity, new cells are being made at a very rapid rate. For humans, the most rapid growth rate of all comes *before birth*. Growth doesn't stop there, of course. Humans continue to grow for as long as twenty years.

In simple terms, growth means tissues become larger. Growth of some tissue, such as bone, occurs because cells reproduce and multiply. Growth of other tissue, such as muscle, occurs because cells get larger. Growth slows down and eventually levels off because the body simply could not support indefinite growth. Your students will be able to see why this is true once they do the calculations on work sheet H. Children are often fascinated to imagine what it would be like to keep growing at the same rate they did as babies. In this mind-bending math exercise, they can figure out how big they would be today if they had continued to grow that fast.

In question 3d of work sheet H, your students can either calculate their actual growth rate for the first year or use the average of three times birth weight. If necessary, do a sample problem for the class, using the average birth weight of 7 lb. 4 oz. (or 7.25 lb.). Multiply 7.25 by 3 to find the weight at one year (21.75 lb.). Multiply 21.75 by 3 to get the weight at

(continued)



G For Activity 4

Growing Yeast

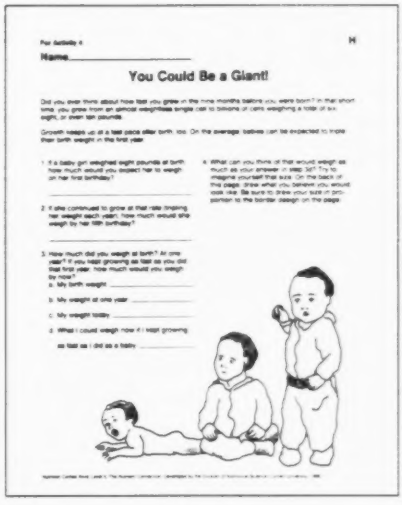
There is a reason your internal climate stays fairly constant. All the chemical reactions that go on inside your body are very sensitive to temperature. If your body temperature changes too much, those reactions suffer, and so do you. In this experiment you will test the effect of temperature on the chemical reactions in a living one-celled organism.

Materials
Pencil and paper
4 small glasses
Measuring spoons
Active dry yeast
Granulated sugar
Stirring spoon
Water
Small saucepan
Hot plate
Bowl
Ice

Procedure
1. Label the 4 glasses A, B, C, and D.
2. Put 1 teaspoon of active dry yeast into each glass. Add 1 teaspoon of sugar to the glasses marked B, C, and D. Stir 2 tablespoons of lukewarm water (110–115 degrees F) into each of the four glasses.
3. Let glass A and glass B sit at room temperature while you go on to step 4.
4. Pour the contents of glass C into the saucepan. Heat to boiling on the hot plate. Cool to lukewarm. Pour the mixture back into glass C.
5. Place glass D in a bowl of ice for 30 minutes. Remove the glass from the ice and leave it at room temperature for 30 more minutes.

Observations
1. What happened to the yeast mixtures in each of the four glasses?
2. What happened after glass D sat at room temperature for 30 minutes?
3. At which temperature did the yeast grow most quickly?
4. Why was table sugar added to the yeast–water solution? Remember that there was no sugar in glass A.

To Learn More
Look up several bread recipes calling for yeast. What purpose does the yeast serve in the recipes? Do the recipes also call for sugar or honey? Why?



For Activity 4 H

Name _____

You Could Be a Giant!

Did you ever think about how fast you grew in the nine months before you were born? In that short time, you grew from an almost weightless single cell to billions of cells weighing a total of six, eight, or even ten pounds.

Growth keeps up at a fast pace after birth, too. On the average, babies can be expected to more than triple weight in the first year.

1. If a baby girl weighed eight pounds at birth, how much would you expect her to weigh on her first birthday?

2. If she continued to grow at that rate (tripling her weight each year), how much would she weigh by her fifth birthday?

3. How much did you weigh at birth? At one year? If you kept growing as fast as you did that first year, how much would you weigh by now?
   a. My birth weight _____
   b. My weight at one year _____
   c. My weight today _____
   d. What I could weigh now if I kept growing as fast as I did as a baby _____

4. What can you think of that would weigh as much as your answer in step 3d? Try to imagine yourself that size. On the back of this page, draw what you believe you would look like. Be sure to draw your size in proportion to the border design on the page.

two years and so on until you reach ten years. A ten-year-old child would then weigh 428,105 pounds or as much as 39 elephants! (You may round off numbers to make multiplication easier.)

Some students may want to research why growth slows down and what a normal growth curve looks like. Copies of both boys' and girls' growth charts are included in Appendix 3. Have the students ask to see their own growth charts in their medical history files the next time they visit their doctors.

Cells Repair and Replace Themselves

Discuss the following questions in class:

—What happens when cells are damaged?
(Most will replace themselves unless large areas of cells are diseased or damaged.)

—What is happening when you get a bruise on your shin? A cut on your finger? A sunburn on your nose? A blister on your heel?
(The cells in those areas are busily repairing the damage and replacing dead cells. The same happens with inside repairs you cannot see such as broken bones, torn ligaments, and ulcers.)

Explain that even without injury, most cells eventually die and need to be replaced. Red blood cells, for example, replace themselves at the rate of 2 million new cells per second. Fingernails, hair, and skin cells are constantly being replenished. In fact, because cells do change, no one in the class is exactly the same person he or she was even a few months ago.

Additional Activities

Brain Cells Are Unique

Unlike most other cells in the body, nerve cells of the brain and spinal cord cannot be replaced if they are damaged. Have interested students research the following questions and report their findings to the class.

—How can people recover from brain injuries if damaged cells cannot be replaced?

—Why is a broken blood vessel in the brain potentially more serious than in other parts of the body?

—Why are seatbelts and motorcycle helmets so important?

—What effect does drug and alcohol abuse have on the brain? Why is the problem of even more concern with young people?
(See the reference to **Make Up Your Mind about Alcohol** in Resources, Section 1.)

Evaluation

Give a brief quiz using the following or similar questions. Have the students indicate which statements are true of all cells and which are specialized jobs of some cells. Answer "yes" or "no" after each statement.

All cells:

Carry messages _____ (No)

Burn fuel for energy _____ (Yes)

Replace themselves if they are damaged _____ (No)

Carry oxygen through the body _____ (No)

Produce heat _____ (Yes)

Remove wastes from the body _____ (No)

Have the same basic parts _____ (Yes, except mature red blood cells do not have a nucleus.)

Can do the same jobs as every other cell _____ (No)

☞ **Food for Thought**

What is a fever?

Fever is a sign that the body is fighting an infection. As a person's temperature goes up, chemical reactions speed up inside the body to repair damaged tissues more quickly. Most viruses and bacteria can't survive at high temperatures so fever is a way of killing these invaders when they get into the body.

(continued)

Chills are caused by the shivering the muscles do in an attempt to increase the body's temperature. When the crisis has passed, the skin warms up, sweating starts, and the body's temperature goes back down.

The "world's tallest woman" is Sandy Allen, who is 7' 7¼" tall. Sandy was 6' 3" tall by the time she was ten years old. When she was nineteen, doctors discovered a tumor in her pituitary gland that caused her body to produce too much growth hormone. Sandy now works at the Guinness Museum in Niagara Falls, New York.

Section 2

The Nutrient Connection

Nutrients: The Lifeblood of Cells

Understanding:

All cells need nutrients for energy, growth, maintenance, and repair, and these nutrients come from food.

Before You Start

If your students have ever been caught picking at their food, they will love this section of *The Nutrient Connection*. That is exactly what they get the chance to do—pick food apart. This time, though, they will see what makes it tick, in a scientific sense.

The section is organized so that you may cover the nutrients either lightly or in detail, depending on time and the interests, needs, and abilities of your class. The first activity helps students understand that foods contain nutrients. They will discover that most foods contain more than one nutrient but that none have them all. The next seven activities cover water, energy, fat, sugar, protein, vitamins and minerals, and chemical additives in greater depth. These activities give you an opportunity to discuss many of the major issues in nutrition today while engaging your students in a variety of classroom experiences from science experiments to a mock congressional hearing. The final two activities help students begin to apply their knowledge of nutrition in making food choices and improving their own diets.

Activities	Subjects
5. Food: The Undercover Story	Science
6. Water, Water, Everywhere	Science, Math, Art
7. Food for Energy	Science
8. Jack Sprat Could Eat No Fat	Science, Health
9. Sugar Is Sweet and . . .	Science, Health
10. Protein: Blocks to Build With	Language Arts, Science, Social Studies
11. Vitamins and Minerals: The Body's Lifeguards	Science, Health
12. Chemicals Added to Food	Science
13. How Much Is Enough?	Math, Health
14. A Quick Way to See How Well You're Doing	Health, Math

Resources

Resources for Teachers

All about Fat and Cancer Risk. AICR Information Series. 1985. Available from the American Institute for Cancer Research, Washington, DC 20069.

This 16-page leaflet provides helpful basic information about fats and discusses the evidence that links fat to cancer. The leaflet also includes easy-to-read tables showing the fat content of common foods and "fast foods." It concludes with practical hints for reducing dietary fat.

Diet for a Small Planet. F. M. Lappe. New York: Ballantine Books, 1982.

This widely respected book advocates a way of eating that makes the most of the earth's capacity to supply protein. The author has included numerous high-protein, meatless recipes.

Nutritive Value of Foods. USDA Home and Garden Bulletin 72. Revised 1985. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

This bulletin contains nutritive values of commonly used foods. Values for fat, fatty acids, cholesterol, carbohydrates, calcium, phosphorus, iron, potassium, vitamin A, thiamin, riboflavin, niacin, ascorbic acid, and sodium are included. Water and kilocalorie content are also given for each food listed.

Yardsticks for Nutrition. B. Fry. Available from Distribution Center, 7 Research Park, Cornell University, Ithaca, NY 14850.

This educational packet in full color focuses on iron, vitamin A, vitamin C, and calcium—the nutrients frequently low in U.S. diets. Packets contain four nutrient cards and inserts to adapt the resource for many audiences including school-age children. The 16-page teacher's guide explains the use of the packet and describes ten activities for youth and adults.

You Should Know . . . about Food Ingredients. P. Thonney and C. Bisogni. Division of Nutritional Sciences, Cornell University. Available from Distribution Center, 7 Research Park, Cornell University, Ithaca, NY 14850.

This series of ten pamphlets discusses ingredient labels, label claims, safety concerns, functions, and regulations. The titles in the series are *Sweeteners*, *Preservatives*, *Caffeine*, *Flavors*, *Food Colors*, *Added Nutrients*, *Thickeners and Other Ingredients That Affect Texture*, *Nonsugar Sweeteners*, *Bakery Products*, and *Advertising Claims*. An eleventh pamphlet, *Shopper's Guide to Commonly Used Food Ingredients*, alphabetically lists food ingredients and their functions.

Resources for Students

The Chemicals We Eat and Drink. A. Silverstein and V. Silverstein. Chicago: Follett, 1973.

In this book, the authors discuss both beneficial and harmful chemicals in food, including natural food components, natural and synthetic food additives, environmental contaminants, and pesticide residues.

Eating the Vegetarian Way. L. Perl. New York: Morrow, 1980.

In this Morrow Junior Book, Lila Perl describes the origins and justifications for vegetarianism. The book includes an explanation of complementary plant proteins and a selection of vegetarian recipes.

Folk Toys around the World and How to Make Them. V. Fowler. Englewood Cliffs, NJ: Prentice-Hall, 1984.
Among the toys described in this book are early American apple head dolls. Easy-to-follow instructions show how to make and dress the dolls.

The Golden Book of Colonial Crafts. New York: Golden Press, 1975.
In an informative chapter on dolls and doll clothes, step-by-step photos show how to make the colonial version of apple head dolls.

How Did We Find Out about Vitamins? I. Asimov. New York: Walker, 1974.
The popular science writer Isaac Asimov turns his attention to the fascinating history of vitamin discovery. The book is written for children ten to thirteen years old.

Mountain People, Mountain Crafts. E. L. Horwitz. New York: Lippincott, 1974.
Excellent photographs help the reader visualize the steps in creating the mountain people's crafts, including their version of apple head dolls.

Computer Software

Eat Smart. Available from Consumer Public Relations, M/S 3286, Pillsbury Company, Pillsbury Center, Minneapolis, MN 55402.
This software is programmed for an Apple II (48K) microcomputer. Users select what they would eat in a typical day from a list of 136 foods. The computer's nutrition analysis of each food, each meal, and the day's total appears on the video screen, along with suggestions for improving the diet. The analysis is given as a percentage of each user's RDA for key nutrients and considers age, sex, and special requirements.

Food Encounters. National Dairy Council. Addresses of local offices in New York State are listed in Appendix 2. Two floppy disks, 28-page teacher's guide, and 28-page user's guide.
This computer courseware is programmed in color with optional sound for use with the Apple IIe (64K) microcomputer. The program assigns students in grades 3–6 to deliver nutritious foods to space stations. Students are given the information they need to understand the four food groups and the foods that belong in each group. In addition, the major nutrients supplied by each group are given. Foods that lack the nutrients to belong in any of the four food groups are in the "others" category. If students err, the program automatically moves them to a remedial educational loop. If they still do not grasp the concept, they are referred to the "Space Commander's Guide to Good Nutrition," in the user's guide.

What I Usually Eat. National Dairy Council. Addresses of local offices in New York State are listed in Appendix 2. Two floppy disks and an 8-page teacher's guide.
This computer courseware is programmed in color with optional sound for use with Apple II Plus or IIe microcomputers with at least 48K. The program uses the four food groups to evaluate students' food choices for one day. The teacher receives profiles of food intake for individuals or the total class. The program was developed in cooperation with Iowa State University for grades 3–6.

Audio-Visual Resources

Dok's Nutrient Computer. 13-minute film. Available for rent from Audio-Visual Resource Center, 8 Research Park, Cornell University, Ithaca, NY 14850. Catalog available on request.

The inimitable Muppets use a "nutrient computer" to show what nutrients (protein, carbohydrates, minerals, fats, vitamins) are in each of the major food groups. The program was developed at the University of Illinois.

Food Comparison Cards. National Dairy Council. Addresses of local offices in New York State are listed in Appendix 2.

Based on the U.S. Recommended Dietary Allowances, colorful bar graphs show the nutrient profiles of 60 different foods.

Food Models. National Dairy Council. Addresses of local offices in New York State are listed in Appendix 2.

Life-size color photographs of 146 foods can be used in a variety of teaching situations. Nutrient values and their contribution to the U.S. RDA are printed on the back of each model.

Guide to Good Eating . . . A Recommended Daily Pattern. National Dairy Council. Addresses of local offices in New York State are listed in Appendix 2.

This full-color poster of the four food groups and others includes a "Nutrients for Health" chart on the back. Miniature versions of the poster are also available in both English and Spanish.

Food: The Undercover Story

Advance Preparation

Look over information sheets I and J. Copy for handouts, if desired.

Read work sheet K and decide whether to conduct the three tests simultaneously or on different days.

Make a copy of work sheet K for each testing station.

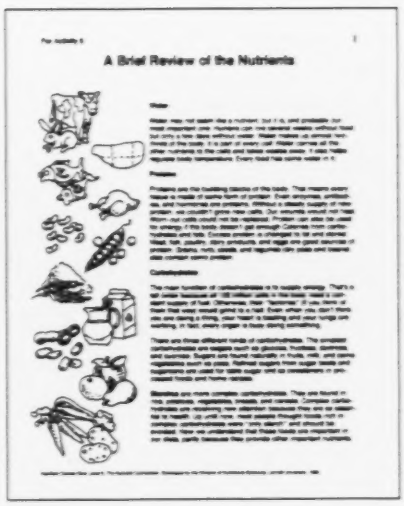
Set up the three testing stations with the materials listed on work sheet K. (Copper sulfate should be available through the high school chemistry department. You will need to mix it with water to make a 3 percent solution. It will be used as an indicator for protein.)

Provide five of the following food samples at each station. (Solid foods should be mashed or in small pieces for the protein test.)

- Milk
- Bread or soft bread crumbs
- Almond
- Banana
- Potato
- Optional: apple, rice, tofu, fresh mushroom, colorless soft drink, cooked fish, hard-cooked egg white

Review your school district's laboratory safety procedures. Caution students to be careful with iodine, copper sulfate, and ammonia and not to eat any of the foods they have tested.

Have one of the following references available: food composition table (Appendix 4) or ***Nutritive Value of Foods*** (Resources, Section 2).


A Brief Review of the Nutrients

The Cells' Raw Materials

Where do the raw materials come from that the cells need for the chemical reactions that keep us alive? From food, of course.

It's not the food itself the cells need, though. It's the nutrients in the food. These nutrients, then, are the true "raw materials."

There are more than fifty different nutrients that we know of. Fortunately, we don't have to memorize them all. Scientists have grouped them into six convenient categories that make them a lot easier to remember:

- Water
- Proteins
- Carbohydrates
- Fats
- Vitamins
- Minerals

(continued)

Most foods contain several nutrients. But no one food contains them all. That is why it is especially important to eat a variety of foods instead of sticking to a few favorites day in and day out.

For a review of each of these six nutrient groups, see information sheet I. Information sheet J briefly summarizes what the nutrients do and what foods are the best sources.

Testing Foods for Nutrients

To demonstrate that foods contain these invisible nutrients, have the students conduct three separate tests for carbohydrates, fats, and proteins. The tests for carbohydrates and fats are simpler and more dramatic than the one for protein. Most laboratory tests for protein are too sophisticated for classroom use. The one included here is chosen because the chemicals are easily available to teachers. Like most lab tests, it uses a copper reagent and a basic solution to show a color change in the presence of protein.

Bear in mind that, in the laboratory, scientists often look for subtle changes and variations of color. Some blue color will appear in most of your tests for protein, so it is important that the students watch for a dark violet color. Only white foods are suggested for testing so your students can see a color change without the food's own color interfering.

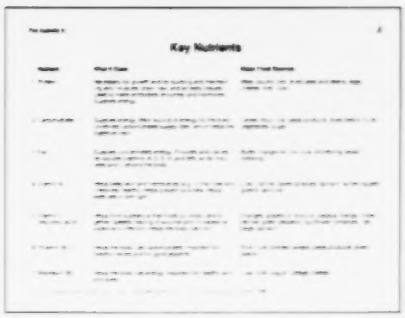
The carbohydrate test will indicate only the presence of starch, not sugar. Therefore, foods such as milk, ripe bananas, apples, and soft drinks will not turn the iodine blue because the carbohydrates they contain are in the form of simple sugars. An unripe apple or banana will show a positive test for starch but a riper one may not. That is because starch changes to sugar as fruit ripens.

You may choose to conduct these food experiments one at a time on different days. Or you may have different groups of students testing for different nutrients simultaneously. In the latter case, divide the class into three teams and give each team the same five foods to test. One team would test each food for carbohydrate. The second team would test the same foods for fat. And the third team would test them for protein. If time permits, the teams could move to each of the three stations.

When you are finished, check your results against the food composition table (Appendix 4) or ***Nutritive Value of Foods*** (Resources, Section 2).

Evaluation

The completed Experiment Data Sheets (with work sheet K) will allow you to evaluate how well the students understood the experiment. You may also have students write a short description of the experiment, summarizing what they did and what they discovered about the nutrients in each of the five foods.


Key Nutrients

Name _____

Food: The Undercover Story

Test Station 1:
Carbohydrates (Starch)

Test Station 2:
Fat

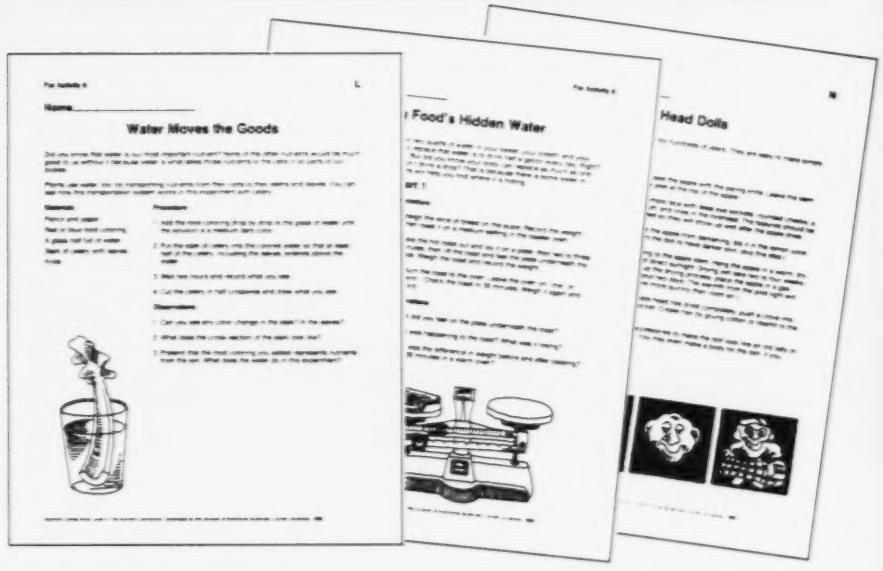
Activity 6

Discovering that water is critical to life

Science, Math, Art

The Nutrient Connection **Section 2**

Water, Water, Everywhere



Advance Preparation

Collect a funnel, jar, filter paper, table salt, and water.

Copy work sheets L, M, and N and gather the materials listed.

Our Bodies Depend on Water

Water accounts for almost two-thirds of the body's weight. That means a ninety-pound child would weigh a mere thirty pounds if all the water in his or her body were drained off. That wouldn't be possible, of course, because water is hidden away inside each cell.

None of the other nutrients would be much good to us without water because water is what takes those nutrients where they have to go. Ninety percent of blood is water, and blood carries nutrients to the cells. It transports waste products away to the liver, kidneys, and skin for disposal. Water also helps regulate body temperature by evaporating and cooling the skin when people perspire.

You can illustrate for the class how water dissolves and transports nutrients by placing some dry table salt on filter paper. The salt will not be able to pass through the paper. Now put some filter paper inside a funnel. Sprinkle salt into the funnel, then pour water through it into a jar. Have a student taste the water before and after pouring it over the salt. How does the water taste?

Plants Need Water, Too

Like humans and animals, plants need a means of transporting materials throughout their tissues. Again, it's water to the rescue—this time to dissolve and carry nutrients from the roots to the stems and leaves. Work sheet L demonstrates this movement in celery. It may be done as a demonstration or as an individual student project.

Losses Add Up

The body loses about two and a half quarts of water every day in urine, feces, perspiration, and breathing. Have students exhale on a mirror or windowpane to see the moisture in their breath. All the water the body loses has to be replaced.

Where Water Comes From

List the following foods and beverages on the board:

- Milk
- Orange juice
- Cola
- Grapes
- Watermelon
- Banana
- Potato chips
- Nuts
- Bread
- Meat
- Eggs
- Cheese

Ask the students to pick the ones that contain water. After they have finished, explain that all these foods contain water. In an average day, we might consume as much as a quart of water in "dry" foods alone, not to mention beverages.

Next have the class do work sheet M to discover the hidden water in food. By dehydrating and rehydrating certain foods, they will be able to see how the water in a food affects its consistency, flavor, and weight.

(continued)

Work sheet M is divided into three parts. Review the experiments to determine the best way to handle them in your class. For example, you may do Part 1 as a class demonstration, then divide the class into small groups to do Part 2. Part 3 will have to be set up and left undisturbed for several days while the foods dry.

Work sheet N is a fun way to demonstrate what happens when water is removed from food. The students will be able to carve and dry apples to make apple head dolls. You may do this activity in combination with work sheet M or as a separate project. Students who would like to make complete dolls can find instructions for the bodies in various craft books. Three excellent books are listed under Resources, Section 2.

Additional Activity

Dehydrated Foods at the Supermarket

Explain that foods are often dehydrated before they are shipped to the supermarket. Food manufacturers have various reasons for removing water from food. Three common reasons are

A. To make the food easier to carry and store

B. To make the food keep better

C. To give the food a different texture and flavor

Write the following list of foods on the board. Have the class identify the reason each food is sold in a dehydrated form. Write the corresponding letter next to the name of the food.

____ Frozen orange juice concentrate

____ Canned condensed chicken noodle soup

____ Evaporated milk

____ Raisins

____ Tea leaves

____ Instant freeze-dried coffee

____ Nonfat dry milk

____ Oatmeal

____ Melba toast

____ Dried oregano leaves

____ Fruit leathers

____ Beef jerky

____ Condensed mincemeat for pies

Can the students think of other examples of dehydrated foods they have seen or eaten?

Evaluation

Use the students' responses to the questions on the work sheets to evaluate their understanding of the importance of water and its presence in food. You may also use this activity as an opportunity to test your students' skills in using fractions and percentages. A sample problem might be the following:

> Scientists at the United States Department of Agriculture have found that white bread is 36 percent water. If a loaf of white bread weighs 454 grams, how many grams of water does it contain? (163 grams.)

How Much Water Should You Drink?

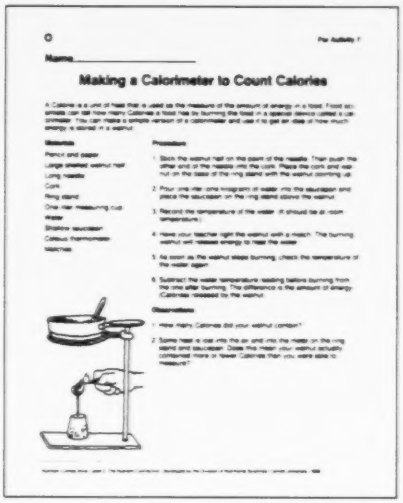
Most experts agree that even though there is water in the foods you eat, it is still important to drink several glasses of water every day. How much you need varies with the foods you eat, how active you are, how much you perspire, and whether you are taking certain medications.

Food for Energy

Advance Preparation

Copy work sheet O and gather the materials listed.

Obtain a set of the National Dairy Council Food Comparison Cards. (If they are not available in your school or local BOCES, contact your nearest Dairy Council office. Addresses are listed in Appendix 2. Examples of the food comparison cards appear in Appendix 6.)



O

Name _____

Making a Calorimeter to Count Calories

A Calorie is a unit of heat that is used as the measure of the amount of energy in a food. Food scientists can tell how many Calories a food has by burning the food in a special device called a calorimeter. You can make a simple version of a calorimeter and use it to get an idea of how much energy is stored in a walnut.

Materials

Pencil and paper
Large shelled walnut half
Long needle
Cork
Ring stand
One-liter measuring cup
Water
Shallow saucepan
Celsius thermometer
Matches

Procedure

1. Stick the walnut half on the point of the needle. Then push the other end of the needle into the cork. Place the cork and walnut on the base of the ring stand with the walnut pointing up.
2. Pour one liter (one kilogram) of water into the saucepan and place the saucepan on the ring stand above the walnut.
3. Record the temperature of the water. (It should be at room temperature.)
4. Have your teacher light the walnut with a match. The burning walnut will release energy to heat the water.
5. As soon as the walnut stops burning, check the temperature of the water again.
6. Subtract the water temperature reading before burning from the one after burning. This difference is the amount of energy (Calories) released by the walnut.

Observations

1. How many Calories did your walnut contain?
2. Some heat is lost into the air and into the metal on the ring stand and saucepan. Does this mean your walnut actually contained more or fewer Calories than you were able to measure?

Food Supplies the Body's Energy Needs

Obviously, one of the most important reasons for eating food is for the energy it gives us to do everything from blink an eye to run in a marathon. All the internal body processes we take for granted demand their fair share of energy, too, from digesting food, circulating blood, transmitting nerve messages, to the last chemical reaction in every cell.

Measuring Energy

The amount of energy a food can supply is measured in a unit of heat called a *Calorie*. A Calorie (or *kilocalorie*) represents the amount of heat required to raise the temperature of one kilogram (one liter) of water one degree Celsius. That means one banana (about 100 Calories) would produce enough heat to raise the temperature of a kilogram of water from 0 degrees Celsius (freezing) to 100 degrees Celsius (boiling).

One *calorie*, with a small "c," is the amount of heat needed to raise the temperature of one *gram* of water one degree Celsius. Since Calorie is the precise scientific term, we will use it when referring to the energy values of food.

To find out how many Calories a food has, scientists burn the food under controlled conditions in a laboratory in an apparatus called a calorimeter. A modified version of a calorimeter is described in work sheet O. You and your students can use it to measure the approximate number of Calories in a walnut. Since the calorimeter uses an open flame, this activity should be done as a demonstration or as an individual student project with close adult supervision.

It is important to realize that your calorimeter will not produce as accurate results as a laboratory calorimeter. You are simply giving students the idea of how Calories are measured.

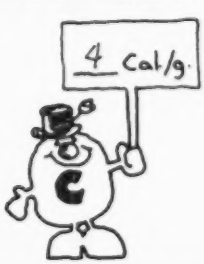
A walnut is used because it burns with a steady flame long enough that you should be able to detect a rise in the temperature of the water. If you do not get a measurable temperature change with one walnut, use additional ones. Then divide the temperature change by the number of walnuts used. Since some of the heat energy from the walnut is lost

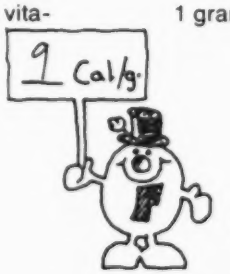
(continued)

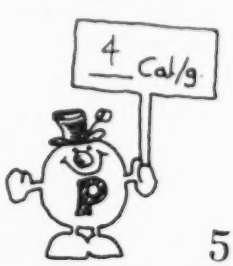
into the air and the metal, the walnut would actually have *more* Calories than your results suggest.

Nutrients That Supply Energy

The three nutrients that supply energy are fats, carbohydrates, and protein. Water has no Calories. Neither do vitamins and minerals. (But carbohydrates, fats, and proteins could not *release* their energy in the body without the help of certain vitamins and minerals.)







50

Most people think of carbohydrates and fats as "fattening." Actually, carbohydrates have no more Calories than proteins. Fats, however, have more than twice the Calories of either carbohydrates or proteins. Their Calorie values are as follows:

1 gram carbohydrate = **4** Calories

1 gram protein = **4** Calories

1 gram fat = **9** Calories

None of these nutrients needs to be fattening. Only excess amounts of each are stored away in the body's "energy bank" in the form of fat cells. The trick is to balance the energy you *consume* with the energy your body *uses*. Of course, no two people are exactly the same. Size, weight, body surface area, and how hard the muscles have to work all affect the amount of energy a person expends.

For a more detailed explanation of energy balance and physical fitness, refer to **Nutrition Comes Alive**, Level 4, ***The Great Balancing Act***.

The Problem with Calories

In this country, many people *take in* more Calories than they *use up*. Over time, those excess Calories

(continued)

add up to create excess body fat. Excessive body fat or obesity increases the risk of diabetes, high blood pressure, and heart disease.

We are a nation of snackers. Unfortunately, many of our favorite snacks are full of Calories but not much else. That is why they are often called "empty-Calorie" foods.

Ask your students to name their favorite snack foods. Brainstorm to get as long a list as possible. Discuss:

—Which ones are likely to be empty-Calorie snacks?

—Which ones would supply nutrients, especially vitamins and minerals, along with the Calories?

Use the food comparison cards from the National Dairy Council to illustrate the difference between an empty-Calorie food and one with a balanced supply of nutrients. Each food card in the series uses a colorful bar graph to depict Calorie content relative to nutrient content so that different foods can be easily compared.

Evaluation

At the end of this activity, your class should be able to answer the following questions.

1. What is a Calorie?

   a. A unit of weight used to measure amounts of food

   b. A unit of heat used to measure energy in food

   c. A unit of time used to measure how long food keeps

2. Which three nutrients supply Calories in food?

   a. Water, protein, fat

   b. Protein, vitamins, minerals

   c. Carbohydrate, protein, fat

3. A person who regularly eats more Calories than he or she uses up in exercise will probably:

   a. Gain weight

   b. Lose weight

   c. Stay the same weight

4. Which of these drinks contains "empty Calories"?

   a. Grape-flavored soda

   b. Orange juice

   c. Chocolate milk

5. A scientist burned a bagel in a calorimeter. He found that the temperature of a kilogram of water went from 37 degrees to 92 degrees Celsius. How many Calories did the bagel contain?

   a. 92

   b. 55

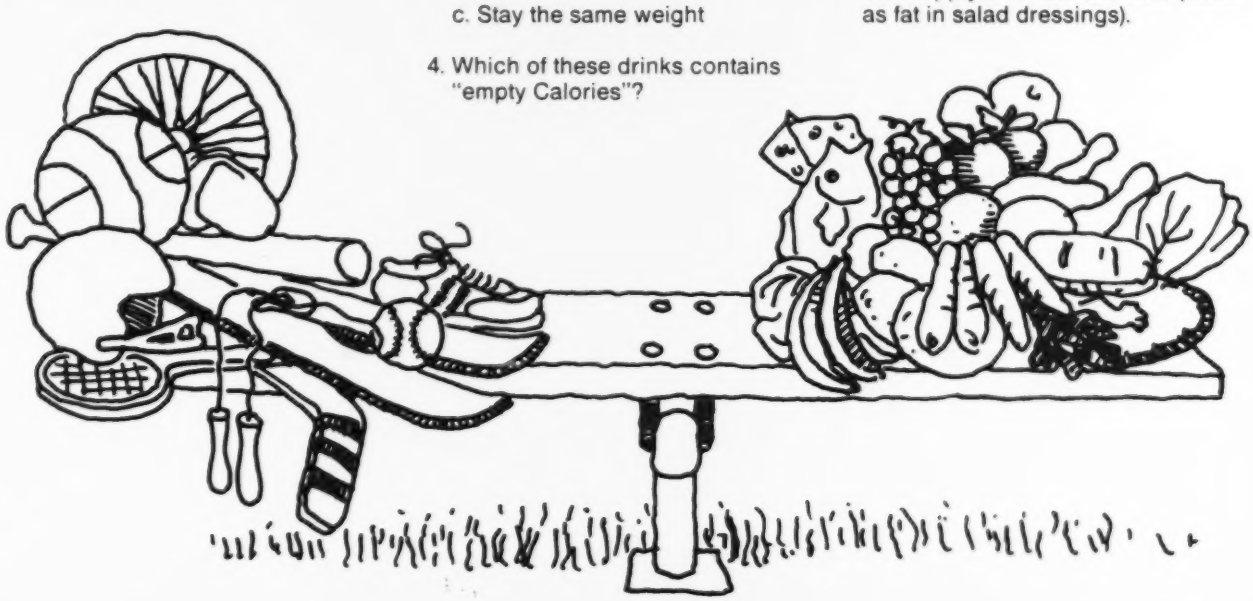
   c. 129

Answers: 1. b 2. c 3. a 4. a 5. b

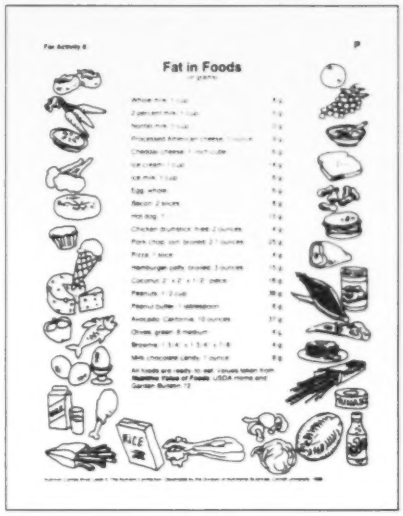
☞ **Food for Thought**

Many foods are now being marketed as "Light" or "Lite." What do those words mean on food labels?

"Light" and "Lite" mean "reduced Calorie." Such products often contain one-third fewer Calories than the regular product. Food scientists reformulate the product using smaller amounts of the ingredients that supply the most Calories (such as fat in salad dressings).



Jack Sprat Could Eat No Fat



Advance Preparation

Set up a display of fats, including butter, lard or suet, margarine, solid vegetable shortening, and liquid vegetable oil.

Ask the students to bring in food labels to examine for information about fat content.

Bring to class a stick of butter or margarine and four or five foods from the list on information sheet P. Optional: Also bring a 4-ounce uncooked hamburger patty, dry milk powder, a glass, a diet scale or balance, and an electric skillet.

Optional: Read ***All about Fat and Cancer Risk*** (Resources, Section 2) for additional background information.

Americans Eat Too Much Fat

Your students are probably aware that the high fat content of the American diet is a cause of real concern today. The issues are complex, and there are many conflicting messages for the consumer to sort out. But one message is clear: *Many of us eat unhealthy amounts of this nutrient.*

You can help your students understand what is meant by saturated and unsaturated fats and cholesterol so they will be more knowledgeable when they see and hear these terms. Beyond that, you can help them to be more aware of foods that are high in fats and to strive for the dietary goal of *reducing overall fat consumption.* The goal that has been set for Americans by the U.S. Senate Select Committee on Nutrition and Human Needs is to reduce the proportion of fat in the diet to no more than 30 percent of total Calories. The typical American gets about 40 percent of his or her Calories from fat. An "average" ten-year-old would need to reduce fat intake from 107 grams to 80 grams a day to meet the dietary goal. (The RDA for Calories is 2400 for ten-year-old children. One gram of fat supplies 9 Calories.)

Fats by Definition

With your display of fats in front of you, explain to the class that foods contain different types of fats. The ones they hear about most are **saturated fats, unsaturated fats, and cholesterol.**

The basic difference between a saturated and an unsaturated fat is the number of hydrogen atoms in the fat molecule. The more hydrogen, the more saturated the fat. Generally, saturated fats are solid at room temperature and come from animal sources. Unsaturated fats are usually liquid at room temperature and come primarily from plant sources. Point out the differences in your display of animal and vegetable fats.

But be careful. Telling which is which can be tricky. Coconut and palm oils are saturated even though they are vegetable fats. And food manufacturers can make liquid vegetable fats firmer (more saturated) by adding hydrogen to them at the factory. **Hydrogenation** is what makes vegetable shortenings and margarines solid. For example, a solid stick margarine has more hydrogen in the

(continued)

fat molecules than a soft tub margarine. Therefore, it is more *saturated.*

Cholesterol is a fatlike substance that is so important to our bodies that we make it ourselves. We also eat it in foods from animal sources, especially egg yolks and organ meats such as liver. Cholesterol becomes a problem when it builds up to high levels in the blood and is deposited along the walls of the blood vessels and arteries. These deposits can cut down the flow of blood to the heart and other parts of the body. Over time, this restricted blood flow can lead to heart attacks, strokes, and other health problems.

Scientists believe that eating a diet rich in saturated fats can *raise* cholesterol levels in the blood and lead to heart disease, strokes, and other serious diseases. Unsaturated fats have been found to *lower* blood cholesterol, but they are also more closely linked to certain forms of cancer. It is not yet clear how the cholesterol we eat relates to either heart disease or cancer. Since all the relationships between fat and risk of disease are not understood, scientists advise people to *limit the amount of fat, regardless of type.*

Labels Tell a Story

Have the class bring in labels from packaged foods such as oils, shortenings, margarines, candies, cake mixes, baked goods, cereals, and hot dogs. Examine the labels.

—Is fat listed in the ingredient list?

—If so, what kinds?

—What does the nutrition information panel tell you about the amount of fat? Does it give any other information?

The label on a package of turkey hot dogs claims that it "contains 18% fat when the law allows up to 30%." That is an appealing claim to consumers who want to cut down on fat. That claim, however, means the hot dogs are *18% fat by weight.* The small print in the nutrition panel tells you that each hot dog contains 10 grams of fat and supplies 130 Calories. You remember that 1 gram of fat has 9 Calories, so 10 grams would have 90 Calories. That means 70 percent of the Calories (90 out of 130) in that hot dog comes from fat.

The Hidden Fat in Food

We expect hot dogs and other luncheon meats to be high in fat. But fat hides in many foods we don't think of as being fatty. It also hides in many foods that don't have nutrition labels or ingredient lists.

You can reveal those hidden fats to your students by using pats of butter or margarine to represent the fat content.

- Read information sheet P and select four or five foods from the list to bring to class.
- Cut a stick of butter or margarine into pats 1" x 1" x 1/3". (Each pat will contain about 4 grams of fat.)
- Place the corresponding number of pats next to each food in your display.

For example, you might select the following:

1 cup of whole milk, 8 grams (2 pats)

1-inch cube of cheddar cheese, 6 grams (1 1/2 pats)

1/2 cup of peanuts, 36 grams (9 pats)

1 hot dog, 15 grams (3 3/4 pats)

Have the class go through the rest of the "Fat in Foods" list to calculate how many pats of fat each food would have.

Measuring the Fat in a Hamburger

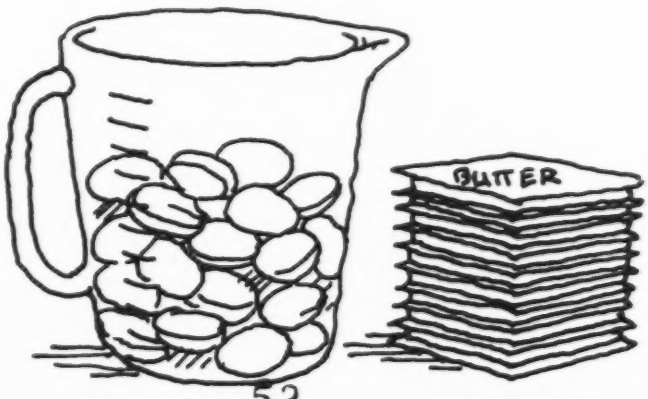
Another way to demonstrate hidden fat is to have the class figure out how much fat is in a hamburger. Bring to class a 4-ounce uncooked hamburger patty. Have the class examine the raw meat.

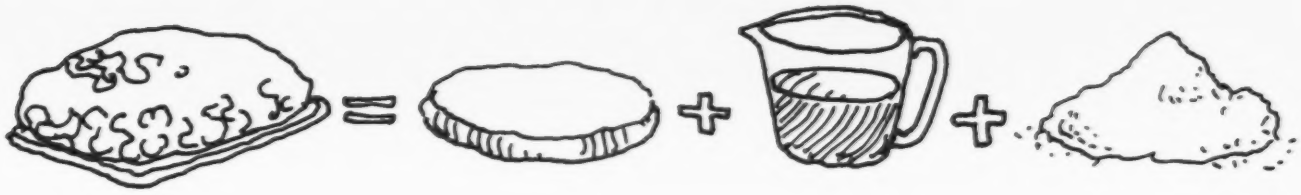
—Can they see any fat?

—What color is it?

Panbroil the hamburger patty in an electric skillet until the meat is well cooked. Carefully drain off the fat and transfer it to a small preweighed glass. Weigh the glass with the fat in it.

(continued)





—How much does the drained fat weigh?

—Is any fat left in the hamburger? (Yes.)

A 4-ounce (120-gram) hamburger contains approximately 1 ounce (30 grams) of protein. Using nonfat dry milk to represent protein, weigh out 1 ounce (30 grams) and display it next to the fat drained from your cooked hamburger patty. Is there more fat or more protein by weight?

Weigh the cooked hamburger patty. How much does it weigh now? (A 3-ounce cooked hamburger patty contains approximately 10 to 20 grams of fat, depending upon how lean the meat was to begin with.)

Additional Activity

Writing an Information Sheet on Fats

Have the class brainstorm ways to reduce the amount of fat we eat. For example, your list might include:

- Put less butter, margarine, and fatty spreads on bread.
- Use less sour cream, gravies, and fatty toppings on potatoes, pastas, and rice.
- Choose salad dressings with low fat content.
- Cut down on high-fat snacks such as peanuts, potato chips, cheese, and ice cream.
- Read food labels and try to choose foods labeled "low fat."
- Substitute low-fat foods for high-fat ones (ice milk for ice cream, low-fat yogurt for sour cream, fruit or vegetable snacks for nuts, chicken for hot dogs or hamburgers, broiled instead of fried foods).

What other ideas can you add? Use your list of suggestions to create an information sheet on fats that your students can share with their families.

Evaluation

Use your class discussions to evaluate students' understanding of the issues related to fat in the American diet. You may also wish to give a brief quiz similar to the following:

True or False

____ 1. Saturated fats come mostly from animal sources. (True)

____ 2. High levels of cholesterol in the blood are a concern because the cholesterol can be deposited on the walls of blood vessels and arteries. (True)

____ 3. To lower our risk of heart disease, we need only cut down on foods rich in cholesterol. (False)

____ 4. Any food containing fat has its fat content listed on the label. (False)

____ 5. A dietary goal for Americans is to reduce all fat in the diet to no more than 30 percent of total Calorie intake. (True)

Sugar Is Sweet and . . .

Advance Preparation

Make arrangements to visit a nearby supermarket or grocery store.

Copy letter Q for parents and send it home with students before using the dental disclosing tablets in class. (The letter is available in both English and Spanish.)

Read work sheet R and make copies of the "Testimony" for use in class.

Bring to class a small quantity of sugar and a set of measuring spoons.

Purchase a package of 30 Red Cote dental disclosing tablets from a pharmacy. Optional: Bring in small paper cups for each student and a large bucket.

Sugar Crops Up Everywhere

Mary Poppins sang a song that goes, "A spoonful of sugar helps the medicine go down." She seems to have convinced the food and drug industries because sugar crops up as an "added ingredient" in the most unlikely places. Soda crackers, spaghetti sauce, soups, ketchup, salad dressings, "adult" as well as children's cereals, even some table salts have sugar added. And, of course, so do many medicines.

Sugar by Any Other Name

When you and your class start looking for sugar on the labels of the foods you eat, you may not see the word "sugar" in the ingredient list even if you know the product contains it. That's because sugar comes in many disguises. The word "sugar" on a label refers only to cane or beet sugar. But other sugary sweeteners are often added to foods.

Write this ingredient list (from a cereal package) on the board:

OAT FLOUR, SUGAR, DEFATTED WHEAT GERM, WHEAT STARCH, HONEY, BROWN SUGAR SYRUP, SALT, ALMONDS, TRISODIUM PHOSPHATE, SODIUM ASCORBATE (VITAMIN C), CALICUM CARBONATE (PROVIDES CALCIUM), NIACIN (A B-VITAMIN), IRON (A MINERAL NUTRIENT), VITAMIN A PALMITATE, PYRIDOXIN HYDROCHLORIDE (VITAMIN B–6), RIBOFLAVIN (VITAMIN B–2), THIAMIN MONONITRATE (VITAMIN B–1), VITAMIN B–12 AND VITAMIN D.

How many "sugars" can the class find? (Sugar, honey, brown sugar syrup.)

The following are other forms of sugar:

- Corn sugar
- Corn syrup
- Molasses
- Invert sugar
- Sucrose
- Fructose
- Glucose
- Dextrose
- Maltose
- Lactose

(continued)

Most product labels do not say exactly *how much* sugar is present. Cereals are an exception. Many manufacturers are voluntarily listing the number of grams of sugar in cereals. The label with the ingredients list on the previous page also had the information given in the box to the right.

CARBOHYDRATE INFORMATION	
	1 OZ. (28.4 g) SERVING
STARCH AND RELATED CARBOHYDRATES	13 g
SUCROSE AND OTHER SUGARS	10 g
TOTAL CARBOHYDRATES	23 g

Measure out 1/4 teaspoon of sugar to show the class what a gram of sugar looks like. Now measure out 2 1/2 teaspoons of sugar to show how much is hidden in one serving of this cereal (2 1/2 teaspoons equals about 10 grams). Sugar is only one of two carbohydrates in this cereal. The other one is starch. Both contribute about 4 Calories per gram. How many Calories would the carbohydrates provide in a serving of this cereal? (23 g x 4 Calories = 92 Calories)

If possible, take the class to a nearby supermarket or grocery store to find as many foods as possible that have one or more of the above sugars listed on their labels. Take the list of sugar names with you for reference. (As an alternative, the students may report back this information after visiting the supermarket with their families or looking at labels on foods they have at home.)

The Problem Sweet Tooth

No doubt about it. Sugar does taste good to most people, and it makes many foods palatable that might otherwise go uneaten. Eating some sugar is fine, but overdoing it can cause health problems. The major problem is tooth decay. The bacteria that live on teeth have "sweet teeth" of their own. When they are exposed to sugar (sucrose), they form an acid that weakens tooth structure and promotes decay.

A simple and effective way to show your students the invisible plaque buildup on their teeth is to use Red Cote dental disclosing tablets. With parents' permission (see letter Q), have each student chew a tablet and swish it around in the mouth for 30 seconds, then spit out and rinse thoroughly. (Decide in advance whether to do this activity in class, giving each student a paper cup of water and allowing them to spit into a bucket, or to have small groups of students go to the restroom to use the sinks.) The color that remains on the teeth, especially at the gum line and between teeth, shows where harmful dental plaque is hiding.

Some students may want to experiment further with the tablets. For example, they could use the tablets after eating a sugary snack and after eating an apple or carrot to see if there is any difference in the amount of plaque on their teeth.

Ask the students if they think we should give up sugar altogether to save our teeth. The answer is no, but it is important not to eat sticky, sugary foods too often.

Eating some sugar as part of a meal is less damaging to teeth than eating a sugary snack because the other foods at the meal will help scrub the sugar off the teeth. Sticky candies and other sweets will keep the sugar in touch with the teeth for a longer time. Experts also believe that *how often* a person eats sugary foods may make more difference in tooth decay than *how much* is eaten at any one time.

Explain that sugary foods and drinks can crowd out more nutritious foods in the diet. For example, many children and teenagers will take a soft drink over a glass of milk if given the choice. Choosing empty-Calorie foods makes it more difficult to get all the nutrients they need without excess Calories.

The Great Sugar Debate

How do your students feel about the debate over sugar? Let them act out their ideas in a mock congressional hearing called to hear testimony on a proposed warning label for foods containing sugar. The label would read: "This product contains X% sugar. Frequent use contributes to tooth decay and other health problems."

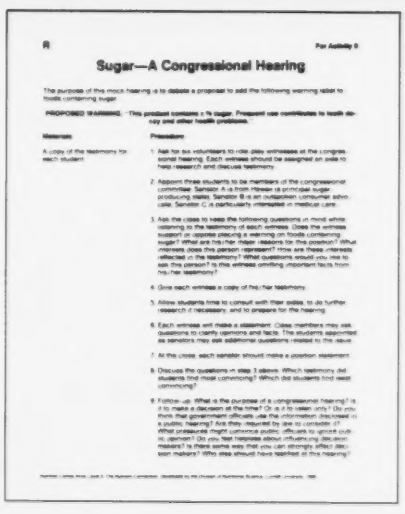
You may use the scripted testimony on work sheet R as it is written or have students research the subject and prepare their own testimony.

(continued)

Besides the roles listed on the script, parts can be created for additional senators, research analysts, and congressional aides. If there are factual errors in the testimony, do not correct the students. Rather, assume that is the position they have chosen to take and try to point out the inaccuracies during the questioning process in the hearing.

Evaluation

The class discussion during the mock congressional hearing will help you evaluate your students' understanding of the controversy surrounding sugar in the American diet. Conclude by making a list of suggestions together that will help the children reduce the amount of sugar they consume.



R For Activity 3

Sugar—A Congressional Hearing

The purpose of this mock hearing is to debate a proposal to add the following warning label to foods containing sugar:

PROPOSED WARNING: This product contains x % sugar. Frequent use contributes to tooth decay and other health problems.

Materials

A copy of the testimony for each student

Procedure

1. Ask for six volunteers to role play witnesses at the congressional hearing. Each witness should be assigned an aide to help research and discuss testimony.
2. Appoint three students to be members of the congressional committee. Senator A is from Hawaii (a principal sugar-producing state). Senator B is an outspoken consumer advocate. Senator C is particularly interested in medical care.
3. Ask the class to keep the following questions in mind while listening to the testimony of each witness: Does the witness support or oppose placing a warning on foods containing sugar? What are his/her major reasons for this position? What interests does this person represent? How are these interests reflected in the testimony? What questions would you like to ask this person? Is this witness omitting important facts from his/her testimony?
4. Give each witness a copy of his/her testimony.
5. Allow students time to consult with their aides, to do further research if necessary, and to prepare for the hearing.
6. Each witness will make a statement. Class members may ask questions to clarify opinions and facts. The students appointed as senators may ask additional questions related to the issue.
7. At the close, each senator should make a position statement.
8. Discuss the questions in step 3 above. Which testimony did students find most convincing? Which did students find least convincing?
9. Follow-up. What is the purpose of a congressional hearing? Is it to make a decision at the time? Or is it to obtain info? Do you think that government officials use the information discussed in a public hearing? Are they required by law to consider it? What pressures might convince public officials to ignore public opinion? Do you feel helpless about influencing decision makers? Is there some way that you can strongly affect decision makers? Who else should have testified at this hearing?

57

☞ Food for Thought

Is honey better for you than sugar?

No. Honey and common table sugar (sucrose) differ mainly in flavor and texture. Both become fructose and glucose when they are used by the body. The cells don't know the difference. Honey does not possess any special health benefits. It does contain tiny amounts of some vitamins and minerals, but the quantities are not significant. One tablespoon of honey contains about 65 Calories compared to sucrose's 45.

Based in part on material prepared by Patricia Thonney and Carole Bisogni, Division of Nutritional Sciences, Cornell University, Ithaca, NY.

Protein: Blocks to Build With

Advance Preparation

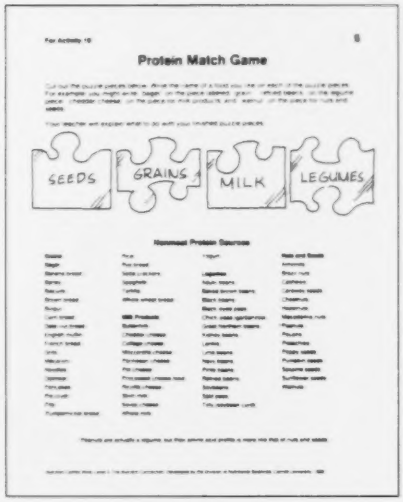
Write the word PROTEINS on the board in bold letters.

Ask students to bring in recipes for their families' favorite meatless main dishes.

Make several copies of the puzzle pieces on work sheet S.

Bring to class a set of the National Dairy Council food models. (If these are not available in your school or local BOCES, contact your nearest Dairy Council Office. See Appendix 2 for locations.) Or copy information sheet T.

Copy work sheet U for each student.



Our Bodies Are Built of Protein

If two-thirds of the human body is water, what's left? Mostly protein. Almost three-fourths of the solid parts of each of us is one form of protein or another. Since there are hundreds of different solid parts in our bodies, there have to be many different proteins.

When humans and animals eat foods containing protein, their bodies break down the protein and rebuild it to custom-make new proteins for their own special needs. That is possible because all those different proteins are put together from the same basic building components in nearly limitless combinations. Those components are called "amino acids." Humans need twenty of them.

An Amino Acid "Alphabet"

Tell the students to think of the twenty amino acids as letters in the alphabet. They know the dictionary is full of words that can be made from just twenty-six letters. That should give them a clue to the number of ways amino acids can be arranged and rearranged to form different proteins.

Just for fun, have the class imagine that each letter in the word **PROTEINS** is a different amino acid. How many different words can they make from the letters **p-r-o-t-e-i-n-s**? This game illustrates how many different proteins can be assembled from just eight amino acids. (Your class should be able to find more than sixty words in the word "protein." Each word should have at least two letters.)

Complete vs. Incomplete Proteins

The human body can make twelve of the twenty amino acids itself. But it has to get the other eight from food. These eight are called **essential amino acids**. Explain that if a food contains *all eight essential amino acids*, it is called a **complete protein** source. Most animal foods (that is, foods such as meat, fish, poultry, milk, cheese, and eggs) are complete proteins.

PROTEINS
SPORT
TIN
STOP
TONS
PIN
TIE

Foods that are *low in or missing some of the essential amino acids* are called **incomplete protein** sources. Plant foods (vegetables, fruits, grains, nuts, and seeds) generally fall into this category. People who depend solely on plant foods for protein have to be careful that their diets include all eight essential amino acids.

(continued)

Some People Eat Less Animal Protein Than Others

Discuss with the class the reasons people may have for eating less animal protein. Here are some examples:

- For many people in the world, animal protein is prohibited for religious reasons, is too expensive, or is too scarce.
- Some people choose not to eat meat, fish, or poultry because they believe it is wrong to kill animals for food.
- Some people limit their consumption of meat because they are concerned about such health issues as consuming too much animal fat.

A diet that includes only plant protein is called a vegetarian diet. Some vegetarians also eat milk (lacto) and eggs (ovo), making them lacto-ovo-vegetarians.

Complementary Proteins

Whatever the reason for choosing a no-meat or low-meat diet, every culture has some favorite vegetarian dishes that provide all eight essential amino acids. When incomplete proteins from different sources match up to supply the right ratio of essential amino acids, they are called **complementary proteins**. Write these examples on the board:

- Tortilla and refried beans
- Macaroni and cheese
- Hummus (Middle Eastern chick-pea and sesame paste dip)
- Boston baked beans and brown bread

59

Now write the following three protein combinations on the board:

- Grains and legumes (dry peas and beans)
- Grains and milk
- Legumes and seeds (includes both seeds and nuts)

Your class should notice that each vegetarian dish falls into one of the three protein combinations. Have them match the vegetarian dishes to the appropriate protein combination.

Other combinations (grains and seeds, or two different grains, for example) *may or may not have all eight essential amino acids.*

Have the class bring in recipes from home of their families' favorite meatless main dishes. Separate the recipes into the three protein combinations: grains and legumes, grains and milk, grains and seeds.

—Is there a recipe that does not fit any of the three categories?

—If there is, can the class think of ways to change the recipe (or foods they could serve with it) that would make it supply complementary proteins?

Protein Match Game

Make copies of the puzzle pieces on work sheet S. Have student volunteers cut out several puzzle pieces in each of the four shapes. Write the name of a grain food on the pieces labeled "grain." (If you need help, see the list of nonmeat protein sources on work sheet S.) Repeat for the puzzle pieces labeled "legume," "milk product," and "seed or nut."

Turn the puzzle pieces face down and scramble them. Have students take turns finding two pieces that will link together. What combinations

(continued)

work? Would they taste good mixed together? If not, could they still be eaten at the same meal?

Getting Enough Protein

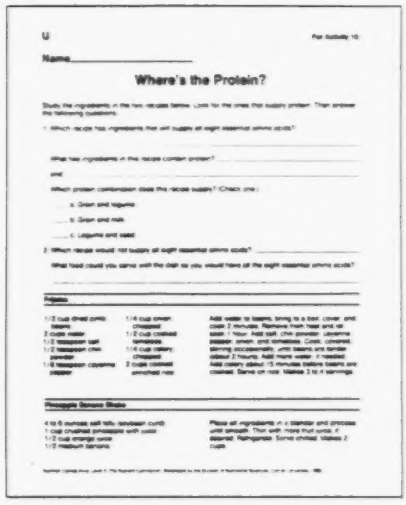
Students hear a lot about protein from parents, teachers, and food advertisers. They may already know how important it is for growth and for repair and replacement of cells. But are they getting enough protein in their diets? Most meat-eating Americans get plenty of protein, even more than they need. Excess protein is burned for energy just as carbohydrates and fats are. Because protein foods are relatively expensive, that's like burning the furniture to heat the house.

People who don't eat much or any meat, fish, poultry, eggs, or dairy products need to be more careful to ensure that they get enough protein. Plant foods not only have incomplete proteins but less protein per serving than animal foods.

Ten-year-old boys and girls need about 34 grams of protein every day. Between the ages of eleven and fourteen, during the adolescent growth spurt, that figure jumps to about 45 grams.

To help students visualize 45 grams of protein, use the National Dairy Council food models to show different foods or combinations of foods that would supply 45 grams of protein. If you do not have access to the food models, refer to the list on information sheet T.

Ask the class to choose a day's supply (45 grams) of protein that includes animal products (meat, fish, poultry). Then have them try to satisfy their protein requirement using *only* milk products, eggs, and plant protein sources.



U

Name_____

Where's the Protein?

—Are the proteins they choose complementary? That is, are they a combination of grains and legumes, grains and milk, or legumes and seeds?

—What happens if they eliminate milk products and eggs?

Additional Activities

Science Experiments with Protein

Because of its unique properties, protein is an interesting nutrient to experiment with. ***Science Experiments You Can Eat*** (General Resources) contains several experiments to illustrate the properties of proteins.

Where's the Protein?

To give your students experience in finding protein in lists of ingredients, use work sheet U. This activity includes two vegetarian recipes for the students to compare. The recipe for frijoles contains two complementary proteins, pinto beans and rice, which are a grain and a legume. The recipe for a pineapple banana shake contains only one protein source, tofu. The students could choose a grain food or a seed food to serve with the shake. They would then have a grain-legume or a legume-seed protein combination.

Evaluation

The activity suggested above in the section "Getting Enough Protein" can serve as evaluation for your study of protein. Or you may use work sheet U as an evaluation activity.

Vitamins and Minerals: The Body's Lifeguards

Advance Preparation

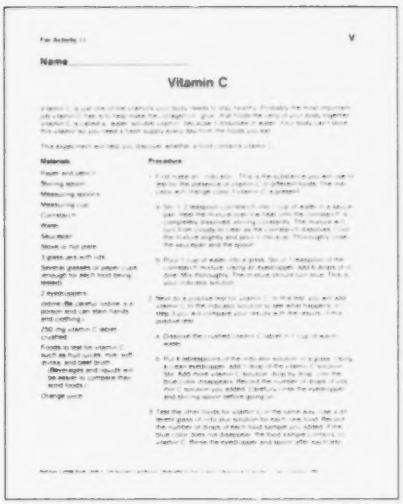
Bring to class a small grape and several grains of sand.

Refer to information sheets I and J for facts on vitamins and minerals. Copy for handouts, if desired.

Copy work sheet V and gather the materials listed.

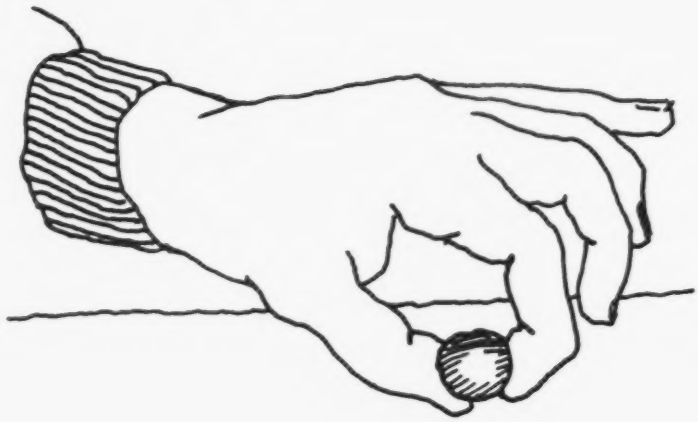
Bring to class a chicken wing bone, a jar, and distilled vinegar. (The bone should be boiled clean and dried.)

Optional: Obtain a copy of ***Nutritive Value of Foods*** (Resources, Section 2).



Name _____

Vitamin C



How Much Do We Need?

Introduce a class discussion of vitamins and minerals by holding up a small grape. Explain that all the vitamins and minerals our bodies need in a day would weigh about as much as this grape. Next show the class a single grain of sand to emphasize that we need only tiny amounts of some minerals, such as iodine.

Even though we need only minute quantities of vitamins and minerals, they are the nutrients most likely to be lacking in our diets. Vitamins and minerals are concentrated in foods that many people do not eat regularly enough. That is especially true for people who do not eat a varied diet, eat many highly processed foods, or go on fad weight-reducing diets. Unfortunately, adolescents are often guilty of all three at the very time their vitamin and mineral requirements are increasing.

Have the class review information sheets I and J for basic facts on vitamins and minerals. Then discuss some of the additional information included in this activity.

Vitamins Are Either Fat-Soluble or Water-Soluble

Vitamins fall into two categories according to whether they dissolve in fat or water. Make two columns on the board, heading one "FAT" and the other "WATER."

List vitamins A, D, E, and K under "FAT." These **fat-soluble** vitamins are digested and absorbed with the help of fat. They can also be stored in the body's fatty tissue and liver. We need to eat foods containing these four vitamins on a regular basis but not necessarily every day. In fact, if we consume excessive amounts of foods rich in vitamins A, D, E, and K or large doses in vitamin pills, the excess vitamins can accumulate and cause a toxic reaction.

Our bodies can make some fat-soluble vitamins. For example, we can make vitamin D in a chemical reaction that takes place when sunlight strikes our skin. That is why vitamin D is sometimes called "the sunshine vitamin."

(continued)

The remaining vitamins are **water-soluble**. These include the eight B vitamins and vitamin C. List these under "WATER" on the board. None of these vitamins can be made in our bodies, and none are stored for very long. Therefore, we must eat a fresh supply every day.

Some Vitamins Are Easily Lost

Just because a food is a good source of a vitamin doesn't guarantee that the vitamin will still be in the food when it is eaten. Vitamins can be destroyed or lost when food is processed. The parts of the wheat kernel (the bran and germ) that are stripped away to make white flour contain important vitamins and minerals. Food manufacturers are required to replace some of these lost nutrients in a process called **enrichment**.

Some vitamins can be destroyed by light or heat. For example, milk will lose more of its riboflavin (a B vitamin) if it is stored in a clear container than it will in an opaque container. Vegetables will retain more of their vitamins if they are cooked in as little water as possible in a covered pan just until they are crisp-tender. Otherwise, the water-soluble vitamins will dissolve in the cooking water and go up in steam or down the drain.

Testing for Vitamin C

Testing foods for most vitamins is complex and unreliable outside the laboratory. A simple test for vitamin C, however, can be done in the classroom. It reveals not only whether a food has vitamin C but how much it has relative to other foods in the test. It also reveals whether vitamin C has been destroyed when a food is cooked or left exposed to light. Work sheet V gives the procedure for the test. A blue indicator solution is used to test for the presence of vitamin C. If vitamin C is present in the test sample, the blue color of the indicator will

disappear. The more vitamin C in the sample, the fewer drops will be required to make the blue color disappear. To simplify the test, use only beverages and liquids (or liquefied solid foods). If you are in doubt about any of your results, refer to ***Nutritive Value of Foods*** (Resources, Section 2) to verify the vitamin C content of your test samples.

Minerals Have Many Jobs

We usually associate minerals with the health of teeth and bones, but other parts of the body also need them. Some minerals help regulate body fluids. Others form parts of chemicals in the body such as hormones and enzymes. Still others help with nerve transmission or muscle contraction.

At least twenty minerals carry out these different jobs. Here are some examples:

- Calcium, phosphorous, magnesium, and fluoride build strong bones and teeth.
- Sodium, potassium, and chloride regulate body fluids and maintain the right amount of water inside the cells.
- Iron helps form hemoglobin, the substance that carries the oxygen in blood.
- Iodine helps form a growth hormone produced by the thyroid gland.
- Sulfur helps shape protein molecules.

Many of the minerals have more than one job. For example, calcium is also important for healthy nerves and proper blood clotting. Certain minerals are called "trace minerals" because they are needed in tiny—or *trace*—amounts. Zinc is an example of a trace mineral. One of its jobs is to keep the taste buds healthy.

It is possible to get all the minerals we need by eating a variety of wholesome foods, especially fruits, vegetables, milk products, whole grains, meat, and legumes. But shortages or deficiencies do happen, and when they do they can have serious results. Calcium is one example of a mineral that is often in short supply in our diets.

(continued)

Calcium and Strong Bones

Calcium is receiving very close attention today because of its association with the disease called **osteoporosis**, which causes bones to become porous and brittle. This disease develops silently over a long period as calcium deposits are gradually withdrawn from the bone "banks" to perform other vital jobs in the body. This happens when the body is not getting enough calcium from food. Since our bone banks are at their fullest by the time we are thirty-five, it is important to get as much calcium as possible in the early years to maintain strong bones in later life.

You can demonstrate how calcium loss affects bones by soaking a chicken bone in vinegar for several days. The vinegar will extract the calcium from the bone, making it soft and pliable. Remind the students that this is just a demonstration. In the body the process takes many years and is not caused by vinegar. The vinegar we swallow is digested and changed. It never touches our bones.

Additional Activities

Library Research

Have students conduct library research projects on one or more of the following topics:

- Fortification (addition of nutrients to foods in the course of processing).
- The discovery of vitamins.
- Vitamin and mineral deficiency diseases such as beri-beri, scurvy, rickets, goiter, osteoporosis, and iron-deficiency anemia. Scientists are discovering that nutrients—especially vitamins and minerals—may also play an important role in preventing some degenerative diseases. For example, studies have shown that people who eat foods rich in beta-carotene (vitamin A) and ascorbic acid (vitamin C) may be less likely to get certain forms of cancer.

Evaluation

Assign individual students to research certain vitamins and minerals. Then have them draw or find a picture of at least one food that is a rich source of that nutrient. Arrange the students' work in a classroom display.

Chemicals Added to Food

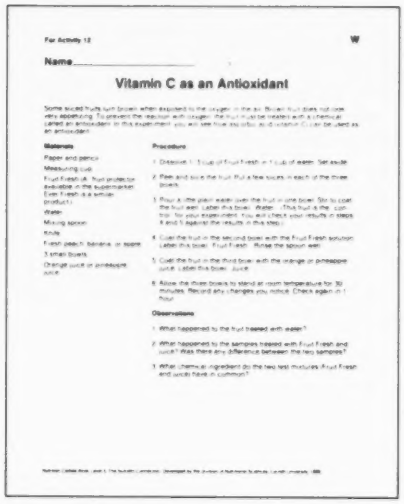
Advance Preparation

Bring in several food labels to check the ingredients lists for food additives.

Copy work sheet W and gather the materials listed.

Bring in paper cups, plastic spoons, a regular and artificially sweetened version of one brand of soft drink, and a regular and artificially sweetened version of one brand of a gelatin dessert (prepared in advance). Blindfolds and drinking straws are optional.

Read through this activity carefully. Because of the nature of the subject, additional background information has been included that you may wish to use as the basis for a class lecture or discussion.



For Activity 12 W

Name_____

Vitamin C as an Antioxidant

Some sliced fruits turn brown when exposed to the oxygen in the air. Brown fruit does not look very appetizing. To prevent the reaction with oxygen, the fruit must be treated with a chemical called an antioxidant. In this experiment you will see how two other antioxidants can be used as an antioxidant.

Materials

Paper and pencil
Measuring cup
Fruit Fresh (A fruit protector available in the supermarket. Even Fresh is a similar product.)
Water
Mixing spoon
3 bowls
Fresh peach, banana, or apple
3 small bowls
Orange juice or pineapple juice

Procedure

1. Dissolve 1 ½ cup of Fruit Fresh in 1 cup of water. Set aside.
2. Peel and slice the fruit. Put a few slices in each of the three bowls.
3. Pour a little plain water over the fruit in one bowl. Stir to coat the fruit well. Label this bowl: Water. This fruit is the control for your experiment. You will check your results in steps 4 and 5 against the results in this step.
4. Coat the fruit in the second bowl with the Fruit Fresh solution. Label this bowl: Fruit Fresh. Rinse the spoon well.
5. Coat the fruit in the third bowl with the orange or pineapple juice. Label this bowl: Juice.
6. Allow the three bowls to stand at room temperature for 30 minutes. Record any changes you notice. Check again in 1 hour.

Observations

1. What happened to the fruit treated with water?
2. What happened to the samples treated with Fruit Fresh and juice? Was there any difference between the two samples?
3. What chemical ingredient do the two test mixtures Fruit Fresh and juice have in common?

Foods Are Made of Chemicals

All nutrients—in fact, all foods—are chemicals. But now that we have so many processed foods in our diet, not all the chemicals are necessarily put there by Mother Nature.

Food chemists can combine chemicals to create new foods in the laboratory. They can also add chemicals to otherwise natural foods. These added chemicals are called "additives." Many of these man-made chemicals are exactly like chemicals found in nature. Vitamin C, for example, has the same chemical make-up whether it is created naturally or in the laboratory. But many other chemicals have been created that do not occur in nature, at least not in foods.

Scientists have developed more than 3,000 different additives to stabilize, tenderize, thicken, harden, clarify, fortify, enrich, keep dry, keep crisp, keep firm, improve appearance, or change how a food looks so it meets the standards manufacturers believe consumers expect.

Sorting Out Additives

Bring in some food labels and have the students look for ingredients they think are chemical additives. Is it easy to tell from the labels which ingredients are chemical additives? Sometimes the manufacturer will reveal what the additives do, especially the preservatives.

Write the following ingredients list on the board.

INGREDIENTS: SUGAR, WATER, PARTIALLY HYDROGENATED VEGETABLE SHORTENING (SOYBEAN AND/OR PALM AND/OR COTTONSEED OIL), COCOA (PROCESSED WITH ALKALI), CORN SYRUP, MODIFIED FOOD STARCH (PROVIDES BODY), SALT (A FLAVOR ENHANCER), SOY LECITHIN, CITRIC ACID (AIDS IN PRESERVING FRESHNESS), POTASSIUM SORBATE (TO PRESERVE FRESHNESS), POLYSORBATE 60 (FOR SMOOTHNESS), MONO- AND DI-GLYCERIDES (PROVIDE

(continued)

SMOOTHNESS), PECTIN (FROM CITRUS), ARTIFICIAL COLOR.

Ask your students:

—Can you guess the product that is made up of these ingredients?
(A creamy, ready-to-spread chocolate frosting.)

—Which ingredients are familiar ones you might use at home?
(Sugar, water, vegetable shortening, cocoa, corn syrup, salt.)

—Which ingredients are chemical preservatives?
(Citric acid, potassium sorbate.)

—Which chemicals are added to ensure that the frosting will be smooth and creamy, as the label claims?
(Polysorbate 60, mono- and diglycerides, pectin.)

Your students may be surprised to learn that they often use additives themselves in their own kitchens. Sometimes they use these additives for the same reasons food manufacturers do. For example, food manufacturers use acids to stabilize foams in whipped toppings. So do home cooks every time they add cream of tartar (an acidic powder) to egg white when making meringue. The acid helps the whipped egg whites hold their shape.

Safety of Additives—An Ongoing Concern

Food companies and government agencies test additives to determine whether they are safe to use. Ones that are considered safe are included on the U.S. Food and Drug Adminstration's GRAS (Generally Recognized as Safe) List. Many additives are retested, even after they have been added to the GRAS List.

Nevertheless, some scientists and consumer advocates are concerned that we may not know as much as we should about all the additives on the GRAS List. They believe the food industry needs to be much more cautious and sparing in its use of additives. Some people even argue that only natural foods are healthy and all chemical additives must be avoided. Unfortunately, the issue of safety is not that simple. Some substances that occur naturally in foods can be harmful, and some chemical additives improve a food's nutritional value or prevent the growth of harmful molds and bacteria.

Let's look at two groups of additives—sugar substitutes and preservatives—in relation to the concern over safety.

The Long Search for a Low-Calorie Sweetener

Food chemists have been trying for decades to create the ideal sugar substitute—one that is safe and tastes as good as sugar without as many Calories. How successful do you think they have been?

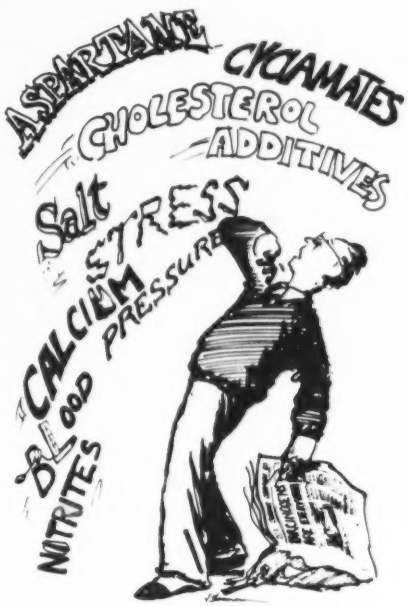
Blind taste tests are often conducted in the food industry, especially when new products are being developed. You can try this technique in class using foods that are the same except for the way they are sweetened. Provide samples of regular and diet soft drinks of the same brand. Also provide samples of regular and artificially sweetened gelatin desserts of the same brand. Number the samples and be sure you are the only person who knows the identity of each one. Have the students taste and compare the products. (Blindfolds are not necessary but may make the testing more fun for the children.) Let them guess which products were artificially sweetened, then discuss how these products compare with the regular versions. Check the labels on the products you tested. What sweetener was used in each?

The Safety of Sugar Substitutes

Next discuss with the class the concern about the safety of sugar substitutes. **Saccharin** and **cyclamates** were once widely used artificial sweeteners, but both were found to cause cancer in laboratory animals when administered in massive doses. Even though some of the studies were later discredited, nagging doubts still remained about the safety of these sweeteners.

Drug companies spent millions to develop a safe sweetener to fill the gap left in the market when the use of saccharin was restricted and cyclamates were taken off the market.

Then along came **aspartame**. A food chemist discovered this chemical by accident when he mixed two amino acids (L-aspartic acid and L-phenylalanine) and got some on his fingers. He absentmindedly licked his fingers and found, to his surprise, that he had created something very sweet. Aspartame has undergone years of rigorous testing since that fateful day and has been proclaimed



(continued)

safe in normal use. There is one exception. Some people have a genetic deficiency called phenylketonuria (PKU) that prevents their bodies from handling phenylalanine properly. As a warning to these people, all products sweetened with aspartame must state: "Phenylketonurics: contains phenylalanine (an amino acid)."

Food Spoilage—An Age-Old Problem

Eating was not especially safe until it became possible to protect foods from microbial spoilage. Molds, bacteria, and yeast are microorganisms that can grow on food. Some are more unsightly than harmful, but many can cause infections and a few can poison.

Exposure to air is responsible for less serious food spoilage. Undesirable changes in color and flavor occur when some foods are exposed to oxygen. Peaches that turn brown when sliced and butter that becomes rancid are two examples.

Preservatives—One Way to Delay Spoilage

Spoilage can be prevented or delayed in several ways. Refrigeration, freezing, canning, or drying offer varying degrees of protection for many foods. Adding chemicals is another option. Salt and sugar were the first chemical preservatives used. Now about twenty different chemicals are used to prevent microbial spoilage. These include benzoates, parabens, propionates, and sorbates. About ten antioxidants are added to prevent spoilage changes caused by oxygen. These include BHT or BHA, EDTA, propyl gallate, alpha tocopherol, citric acid, and ascorbic acid (vitamin C).

At home, we take advantage of ascorbic acid as an antioxidant every time we add oranges or pineapple to a fruit salad. These fruits keep the apples, peaches, and bananas in the salad from turning an unappealing brown color. Your class can study the process more scientifically by doing the experiment on work sheet W. In this experiment, they will coat one bowl of fruit with orange or pineapple juice and another with Fruit Fresh. They will compare the results with a control that has been treated only with water. The fruit in the control should turn brown. The two test samples should not oxidize because both the fruit juice and the Fruit Fresh contain ascorbic acid (vitamin C).

The Safety of Chemical Preservatives

Other chemical preservatives are often in the news because of questions about their safety. Sodium nitrite is one example. It is added to cured meats such as sausages, bacon, hot dogs, and ham because it is the only known chemical that protects against botulism, a deadly food poisoning. Since nitrites can contribute to the formation of a cancer-causing compound in animals, many people have argued that they should be banned. But data collected from a major animal feeding study do not support the earlier conclusion that nitrites themselves cause cancer.

When information about the safety of a chemical additive such as sodium nitrite changes, many consumers feel confused and frustrated. They find it hard to understand how a chemical can be considered safe, then unsafe, and then safe again, or why it takes so long for decisions to be made.

(continued)

The process of determining safety is very complex and time-consuming. New and different methods for measuring safety can give different results. Scientists can interpret the same information in different ways. Consumers will have different opinions, too. It is important to try to base those opinions on facts and not emotional distortions of facts.

Additional Activities

Library Research

Make a list of additives that you and your students have found on product labels. Assign each student to do library research on one additive. Have them find out about the additive's history, why it is used, and what is known about its safety. After the students have completed their reports, discuss the following questions in class.

—What can we do to monitor and possibly reduce the amounts of chemical additives we consume?

—How would our lifestyles have to change if chemical preservatives were no longer added to our food?

—How would our expectations have to change if we chose not to add artificial colorings to our foods?

—What are the pros and cons of using products with artificial sweeteners?

Evaluation

Class discussions will provide the best means to evaluate your students' understanding of the issues surrounding chemical additives.

Based in part on material prepared by Patricia Thonney and Carole Bisogni, Division of Nutritional Sciences, Cornell University, Ithaca, NY 14853.

How Much Is Enough?

Advance Preparation

Copy the food composition table in Appendix 4 and the RDA charts in Appendix 5. Use the tables and charts for a bulletin board display or overhead transparencies or make enough copies to distribute in class.

Copy work sheet X to use with the food composition table.

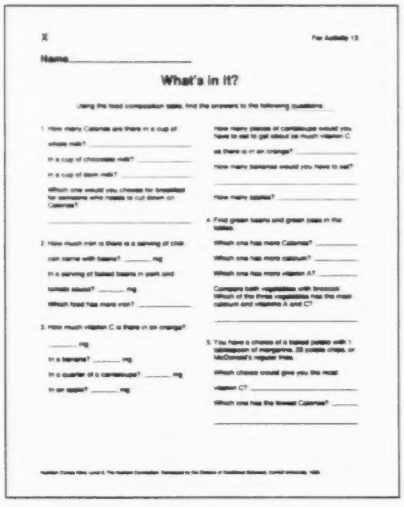
Copy work sheet Y to use with the RDA charts and food composition table.

Ask the class to bring in as many food labels as possible that have "Nutrition Information" panels.

Optional: Obtain a set of the National Dairy Council's food comparison cards. If these cards are not available in your school or local BOCES, contact the nearest Dairy Council office. Addresses are listed in Appendix 2. Examples of the food comparison cards appear in Appendix 6.

Using Our Knowledge of Nutrition

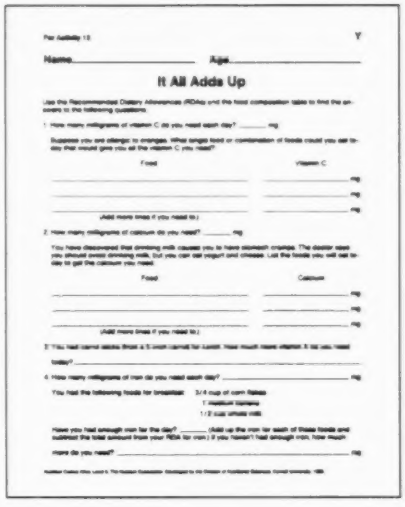
The science of nutrition is a constant attempt to quantify. How much vitamin C is enough? How much cholesterol is safe? Are there more Calories in french fries or in mashed potatoes? It is almost impossible to put our knowledge of nutrition to work unless we know the amounts of nutrients in food or how much of those nutrients our bodies need.



X

Name_____

What's in It?



Name_____ Age_____

It All Adds Up

This activity deals with some of the resources scientists have developed to make nutrition information more accessible. Three resources will be covered in this activity:

Food composition table

Recommended Dietary Allowances (RDAs)

Nutrition labeling

Your class can use some of these resources in much the same way food chemists, nutritionists, and dietitians do. Before beginning the work sheets, be sure the students have some background information on the different tables they will be working with.

Food Composition Table

Show the class copies of the food composition table (Appendix 4). Explain that food chemists have taken apart hundreds of foods in the laboratory to find out what nutrients they contain and how much. They have also burned them in a calorimeter to determine how many Calories they contain.

Most nutrients are measured in grams and milligrams. (If the class hasn't worked with metric weights recently, review these measurements briefly.) Vitamin A is an exception. It is now being measured in REs or retinol equivalents, but most tables still use the former measurement, called International Units (IUs). You needn't go into detail on either of these special forms of measurement because it is more important for your students to compare relative amounts of vitamin A in foods than exact quantities. For more complete food composition tables, see ***Nutritive Value of Foods*** (Resources, Section 2).

Use work sheet X to give your class experience in finding and comparing the nutritive values of different foods listed in the food composition table. (Answers to the work sheet questions are given at the end of this activity.)

Recommended Dietary Allowances

Post the RDA charts on a bulletin board or show them with an overhead projector. Explain that the RDAs are established by the Food and Nutrition Board of the National Academy of Sciences/National Re-

(continued)

search Council as a general guide to how much of certain nutrients people in this country need to stay healthy. The RDA Chart I shows the nutrient requirements for people of average height and weight for their ages. Have the students find where they fit on the chart.

—How many students are the same height and weight as given on the chart for their age?

—Are the height and weight listed on the chart a good average for your class?

—Do your students think height and weight affect nutrient needs? (Most experts believe that the RDAs are generous enough to accommodate a normal range of differences in height and weight.)

The RDA Charts II, III, and IV show the amounts of certain key nutrients males and females need at different times in their lives. As you look over these charts, your discussion might include the following questions:

—Why are there separate categories for boys and girls starting at age eleven?
(Growth, development, and activity levels are much more alike in young boys and girls than they are during adolescence.)

—How do Calorie needs change at age eleven?
(Boys need more Calories. Girls need fewer.)

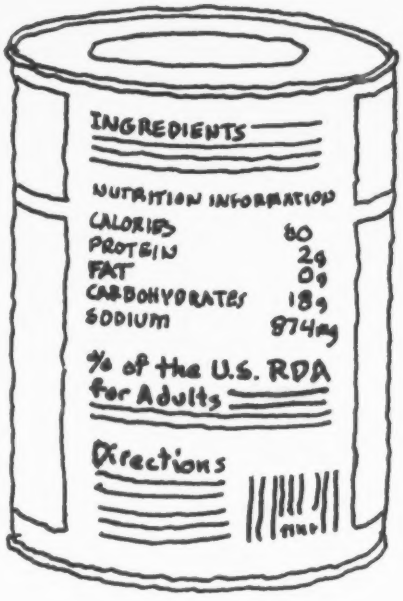
—By how much do calcium requirements go up?
(The RDA increases from 800 mg to 1200 mg, an increase of 50 percent.)
Why?
(Adolescent growth spurt, including rapid bone growth.)

—What happens to protein requirements at age eleven?
(They go up for both boys and girls.)
Why?
(Adolescent growth spurt.)

—At what age do girls' protein needs stop changing?
(Nineteen to twenty-one.)
How about boys?
(Fifteen to eighteen.)
Who needs more?
(Boys.)

—Which nutrient requirements remain fairly constant throughout life?
(Vitamin A, vitamin C, thiamin, riboflavin, niacin.)

Now your students should be ready to use the food composition table and the RDAs to do work sheet Y. Their answers to the work sheet questions will vary with their age and food choices. You may wish to go over their answers in class after they have completed the work sheet.



Nutrition Information on Food Labels

Since the early 1970s, food manufacturers have been required to give consumers nutrition information on foods to which nutrients have been added or for which a nutrition claim is made in advertising. Nutrition labeling is not required for fresh fruits and vegetables, eggs, poultry, meat, and fish or for so-called "fast foods." Some people believe fast foods should be labeled because many contain relatively large amounts of sugar, fat, and salt.

Consumers would like to be able to pick up a food package and find exactly what percentage of their nutrient requirements that food provides. Unfortunately, food manufacturers don't know whether the consumer is a twenty-year-old boy or a fifty-year-old woman. They have tried to solve the problem by creating the **U.S. RDAs**. These are a single set of values taken from the RDA tables. Most of the figures represent the amounts needed by teenage boys or adult men. In the case of iron, the amount given is for adult women. Individuals whose needs differ from those specified in the U.S. RDA will almost surely require less than the amount listed.

Even though the RDAs are updated periodically, the U.S. RDAs have not changed since they were first established. Can your students think of reasons the U.S. RDAs have stayed the same? (The U.S. RDAs are generous to begin with. It would be difficult and costly for food manufacturers to keep changing their food labels.)

Study the nutrition labels your students have collected.

—What information is given?
(See the sample label below.)

—Do all the labels give the same basic information?
(Yes.)

(continued)

—How useful is this information in helping consumers make wise food choices?
(It tells the number of Calories and amounts of key nutrients so consumers will know exactly what is in the product. It is important to remember that the U.S. RDAs are only a general guide, not a perfect system for choosing food.)

What other information can you find on the labels?

- The front of the package must always give the product name, the name and address of the company, and the weight or measure.
- Most labels also have an ingredients list on the front or side of the package. The ingredients are listed in order from most to least. If sugar is listed first on a cereal label, the product contains more sugar than any other ingredient.

Additional Activities

Nutrient Density

Nutrient density is a way of expressing how nutritious a food is in relation to the number of Calories it contains. For example, a soft drink is very low in nutrient density. Milk has many nutrients—some in significant amounts. Therefore, it has a high nutrient density.

The food comparison cards developed by the National Dairy Council are an excellent way to show the nutrient density of common foods. Each comparison card uses a colorful bar graph to illustrate a single food's contribution to the U.S. RDA. You may use the cards in a variety of ways to reinforce the concepts in this activity.

Evaluation

Work sheets X and Y may be used to evaluate the students' learning. Or you may develop similar questions for your students.

(continued)

Have your class compare the nutrition information on the labels of two competing brands of cereal (or any two products that can reasonably be compared.)

Answers to Questions on Work Sheet X

1. 145 Calories in whole milk
   213 Calories in chocolate milk
   77 Calories in skim milk
   Skim milk

2. 4.3 mg in chili con carne
   2.3 mg in baked beans in pork and tomato sauce
   Chili con carne

3. 66 mg in an orange
   12 mg in a banana
   32 mg in a quarter of a cantaloupe
   6 mg in an apple
   2 pieces of cantaloupe
   5 1/2 bananas
   11 apples

4. Green peas
   Green beans
   Green peas
   Broccoli

5. Baked potato with margarine
   Baked potato with margarine

A Quick Way to See How Well You're Doing

Advance Preparation

Examine information sheet Z and determine how you can best use it in your class. (See suggestions in text.)

Copy work sheet AA for each student.

Make one copy of information sheet BB. Cut apart the descriptions of the individual situations.

Optional: Order the following computer software from the National Dairy Council or your local BOCES: **Food Encounters** and **What I Usually Eat** (Resources, Section 2).

Optional: Order Pillsbury's **Eat Smart** computer software (Resources, Section 2).

Z

For Activity 14

Food Groups*

	Choose These Foods Anytime	Choose These Foods Sometimes	Choose These Foods Only as Occasional Treats
Vegetables and Fruits vitamins A and C, dietary fiber 4 servings a day	Canned fruit in water, Fresh fruits and vegetables, Frozen vegetables, Unsweetened fruit juices	Canned in heavy syrup or sugar, Canned vegetables (salt added), Dried fruits, Sweetened fruit juices	French fried potatoes, Olives, Pickles, Potato chips
Bread and Cereal Carbohydrate, B vitamins, iron, some protein 4 servings a day	Oatmeal, Pasta, Whole grain breads and crackers	Granola, Low sugar cereals, White bread	High sugar cereals
Milk and Cheese Protein, calcium, vitamin A (fortified), and vitamin D (if milk is fortified with vitamin D) 3-4 servings a day	Buttermilk, Cottage cheese, Low fat or skim milk, Plain yogurt, Skim milk cheeses	Hard cheeses such as Cheddar and Swiss, Frozen yogurt, Sweetened yogurt, Whole milk	Cheesecake, Ice cream, Ice milk, Processed cheeses such as American
Meat, Poultry, Fish, Dried Peas and Beans Protein, thiamin, niacin, iron and other minerals 2 servings a day	Chicken or turkey (skinless), Dried peas and beans, Fresh or frozen fish, Peanut butter, Tuna (canned drained)	Beef, Chicken or turkey (with skin), Eggs, Fish (canned, salted, pickled, or smoked), Lamb, Pork	Bacon, Hot dogs, Lunch meats, Sausage
Caution Calories but few nutrients		Mayonnaise, Margarine, vegetable oils	Butter, Candy, Cream, Honey, Jams and jellies, Soft drinks, Sugar, Sweet toppings (unenriched, refined flour and baking products)

*These groupings were developed by the U.S. Department of Agriculture as the typical balance of diet. They are often referred to as the Basic Four Food Groups or the Five Food Groups. Some charts divide fruits and vegetables into two groups according to the key nutrients they supply.

Inventing a Daily Food Guide

Write on the board the following list of foods that Josh (a ten-year-old boy) ate in one day:

Breakfast

Apple juice

Pancakes with butter and syrup

Lunch

Peanut butter and jelly sandwich on white bread

Carrot sticks

Twinkie

Milk

Dinner

Pork chop

Mashed potato

Green beans

Chocolate cake

Cola

Snacks

Raisins

Frozen yogurt

Popcorn

Ask the class to take five minutes to look at the list and tell you whether Josh got all the Calories and nutrients he needed. Do not allow them to use the food composition table or the RDAs.

When it becomes obvious that they can't tell whether Josh got all the Calories and nutrients he needed, have the students try to invent a simple way to help people keep track of how well they are eating. Include some of the following points in your discussion:

- Nutrient deficiencies don't show up immediately. Visible symptoms take a long time to develop. Therefore how we feel and look from day to day is not a very reliable guide.
- Most people don't have copies of the food composition table and RDAs. Even if they did, it would be a nuisance to have to use them all the time. Few people would want to be bothered.
- Many of the foods we eat every day don't have nutrition labeling so we can't depend on labels to tell us everything we need to know.

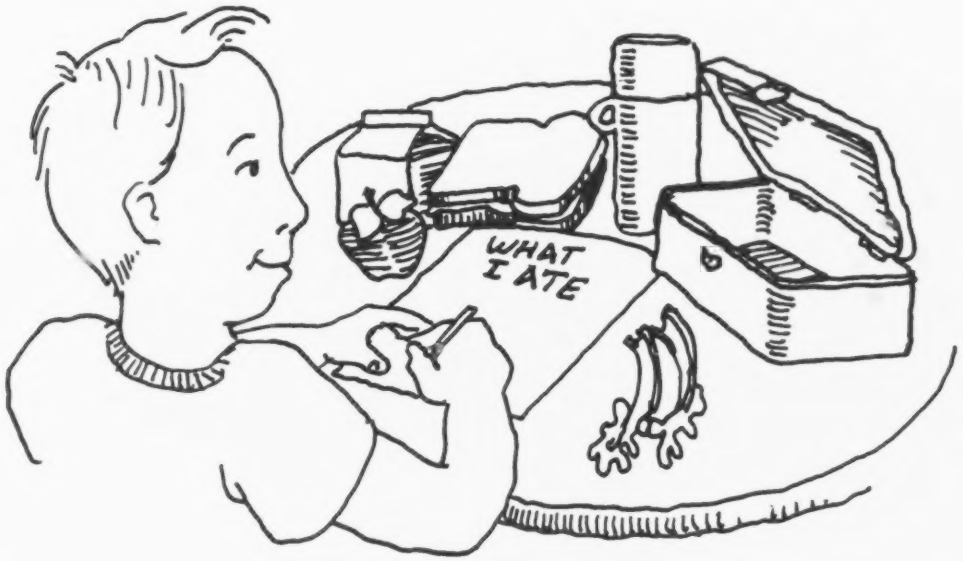
If it seems impossible to come up with a simple, easy-to-use test, bear in mind that scientists and nutritionists have been struggling with this problem for a long time.

Grouping Foods by the Nutrients They Provide

Brainstorm with the students to compile a list of twenty of their favorite foods. Have them study the list and try to think of categories into which they could group the foods.

After the class has worked for a few minutes, explain that one solution is to group foods according to the nutrients they are richest in. The foods in the typical American diet are often

(continued)



grouped into the following four categories:

Vegetables and fruits

Bread and cereal

Milk and cheese

Meat, poultry, fish, dried peas and beans

Nutritionists have determined how many servings from each of these groups we need for a well-balanced diet. When we eat the right number of servings from each of these four groups every day, we can be reasonably sure we are getting the nutrients our cells need. That makes choosing a lot easier.

Of course, this system isn't perfect. Not all foods in a group are equally nutritious. Some are better choices than others because they supply the nutrients we need with less sugar, salt, and fat. Milk and ice cream, for example, are both in the milk and cheese group. A cup of ice cream has the same basic nutrients as a cup of milk, but it has fewer vitamins and minerals. It also has more sugar and fat that add extra Calories.

Foods that are mostly empty Calories (that is, foods that are mostly sugar, fat, or alcohol with few other nutrients) are sometimes lumped into a separate category called the "Caution" group. How many empty-Calorie foods can your class list in one minute?

Information sheet Z shows

The key nutrients each group supplies

The number of servings nutritionists recommend

Some of the foods in each group

How foods in each group compare nutritionally

You can use this chart in several ways in class. Post it on a bulletin board along with a display of foods from each group. Make an overhead transparency of the chart. Photocopy the chart to use in individual or group assignments. Or take information from it to write on the board during class.

Using the Food Groups

Now go back and check Josh's diet against the food groups. As you do this with the class, ask some of the following questions:

—Did Josh get the recommended servings from each group?

—Which foods would you put in the "Caution" group?

—If you could plan Josh's menu for tomorrow, what changes would you make?

—What would you do if Josh didn't like your choices?
(Point out that there is enough variety in each group so that most people can find several foods they like.)

—Would it be all right for Josh to eat the same foods every day?
(Remind the class that not all foods in a group are equally nutritious. The more varied our diets, the better our chances of getting all the nutrients we need.)

(continued)

For Activity 14 AA

Name _____

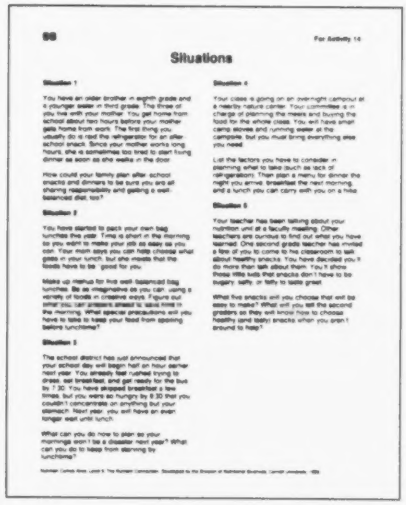
What Did You Eat Today?

1. Keep a list of all the foods you eat today for meals and between-meal snacks.
2. Keep a separate list of any foods you throw away.
3. Put the foods in the proper categories on the chart below.
4. Count the number of servings you had in each food group.

	Vegetables and Fruits	Breads and Cereals	Milk and Cheese	Meat, Poultry, Fish, Dried Peas and Beans	Caution
	4 servings	4 servings	3 servings	4 servings	
Breakfast					
Lunch					
Dinner					
Snacks					
Foods I Threw Away					

Answer the following questions using the information on your chart.

1. Did you have more than enough servings from any of the groups? _____
   If so, which ones? _____
2. Did you have too few servings from any of the groups? _____
   If so, which ones? _____
3. How many servings did you have of foods in the "Caution" column? _____
4. Did you throw away more foods from one group than from any others? _____ If so, which ones? _____
5. Are your snacks all in the "Caution" column or do they add to the servings you need from the four main food groups? _____
6. Look at the food groups chart. What foods could you choose to complete your own food chart? Add the new foods to your chart. Put a star next to them so you will be able to tell which ones you didn't actually eat today.)



BB For Activity 14

Situations

Situation 1

You have an older brother in eighth grade and a younger sister in third grade. The three of you live with your mother. You get home from school about two hours before your mother gets home from work. The first thing you usually do is raid the refrigerator for an after school snack. Since your mother works long hours, she is sometimes too tired to start fixing dinner as soon as she walks in the door.

How could your family plan after school snacks and dinners to be sure you are all sharing responsibility and getting a well-balanced diet, too?

Situation 2

You have started to pack your own bag lunches this year. Time is short in the morning so you want to make your job as easy as you can. Your mom says you can help choose what goes in your lunch, but she insists that the foods have to be "good for you."

Make up menus for five well-balanced bag lunches. Be as imaginative as you can - using a variety of foods in creative ways. Figure out what you can prepare ahead to save time in the morning. What special precautions will you have to take to keep your food from spoiling before lunchtime?

Situation 3

The school district has just announced that your school day will begin half an hour earlier next year. You already feel rushed trying to dress, eat breakfast, and get ready for the bus by 7:30. You have skipped breakfast a few times, but you were so hungry by 9:30 that you couldn't concentrate on anything but your stomach. Next year, you will have an even longer wait until lunch.

What can you do now to plan so your mornings won't be a disaster next year? What can you do to keep from starving by lunchtime?

Situation 4

Your class is going on an overnight campout at a nearby nature center. Your committee is in charge of planning the meals and buying the food for the whole class. You will have small camp stoves and running water at the campsite, but you must bring everything else you need.

List the factors you have to consider in planning what to take (such as lack of refrigeration). Then plan a menu for dinner the night you arrive, breakfast the next morning, and a lunch you can carry with you on a hike.

Situation 5

Your teacher has been talking about your nutrition unit at a faculty meeting. Other teachers are curious to find out what you have learned. One second grade teacher has invited a few of you to come to his classroom to talk about healthy snacks. You have decided you'll do more than talk about them. You'll show those little kids that snacks don't have to be sugary, salty, or fatty to taste great.

What five snacks will you choose that will be easy to make? What will you tell the second graders so they will know how to choose healthy (and tasty) snacks when you aren't around to help?

Keeping a Food Diary

Have each student use work sheet AA to keep track of everything he or she eats for one full day. Tell the students to write down what they actually ate, not what they think they should have eaten. They won't be graded on what they ate.

Keeping a food diary for one day may be all you and your students can manage. Encourage them, though, to keep a diary for three days or more. A longer diary can make a greater impression because students will begin to see patterns. For example, they may find they are lacking key vitamins day after day or are consistently eating more breads and cereals than they need.

It is important to remember that children usually have to eat what others prepare for them. As they gain independence, they also gain more control over their diets. Some of your students may already be doing some of the family shopping and cooking. The more aware they are of what constitutes a well-balanced diet, the better able they will be to make the best possible choices for themselves.

Additional Activities

Planning Meals for Different Situations

Divide the class into groups of four or five. Assign each group one of the situations described in information sheet BB. Allow the groups about fifteen minutes to come up with suggestions for solving their problems. One person in each group should act as a recorder to write down the suggestions. After they have finished, give each group a chance to share its situation with the rest of the class.

Evaluation

Make a list of foods you believe your students might eat in a typical day. Write the list on the board or make individual dittos. Have the students check the list against the **food groups** chart. They should be able to tell you whether the day's menu includes enough servings from each group. If there are too few or too many servings, the students can suggest ways to make the menu more balanced.

Have students use the National Dairy Council's computer programs, **Food Encounters** and **What I Usually Eat** (or Pillsbury's **Eat Smart** program). Watch for new computer software to appear on the market. Preview programs to be sure they are from reliable sources and are suitable evaluation devices for this activity.

Section 3

The Nutrient Connection

Your Amazing Food Tube

Understanding:

As food is digested by the body, nutrients are released and carried by the blood to the waiting cells.

Before You Start

We know that there are 100 trillion busy cells anxiously awaiting their delivery of fuel and raw materials. We know those supplies are locked up in food in the form of nutrients. The question is how those nutrients get from a form we like to eat to a form the cells can use. It all happens inside a 25- to 30-foot-long "food tube" in an amazing process called digestion.

This section gives you and your class the chance to explore the mechanics and chemistry of that amazing process. The activities are wide-ranging to allow for many different classroom experiences.

Your students will learn biology, chemistry, vocabulary, health, and even some important first aid as they study digestion.

In the end, they should have a greater appreciation of how truly remarkable our bodies are. The sturdy and adaptable digestive system is prepared to cope with an almost limitless variety of foodstuffs. But no matter how different our choices of foods are or the ways we prepare them, our bodies still need the same nutrients for the same reason—to nourish our hard-working cells.

Activities	Subject
15. Tracking Food through the Tube	Science, Language Arts
16. The Great Grinding, Mashing, Churning, Splashing Food Machine	Science, Health, First Aid
17. Gut Reactions	Science, Social Studies
18. When All Is Not Well	Science, Health
19. It's the Nutrients That Count	Social Studies, Health

Resources

Resources for Teachers

Dr. Heimlich's Home Guide to Emergency Medical Situations. H. J. Heimlich. New York: Simon and Schuster, 1980.

This book explains 250 common medical emergencies. The section "Choking on Food or a Foreign Object: Applying the Heimlich Maneuver" provides important information on the most widely accepted treatment for choking victims.

The Foodbook. J. Trager. New York: Flare Books, published by Avon, 1970.

The Foodbook is a fascinating guide to every aspect of eating, from cannibalism to cyclamates. Trager explores fundamentals of taste and the vagaries of human eating habits. This is a history, sociology, anthropology, and biology book all rolled into one.

Foods of the World. New York: Time-Life Books, 1970.

This series continues to be among the best resources available on cultural food patterns around the world. Each book in the series covers a particular country or region and contains recipes that are carefully researched for authenticity.

Red-Flannel Hash and Shoo-fly Pie: American Regional Foods and Festivals. L. Perl. Cleveland: World, 1965.

This book tells the story of what Americans eat and why. It traces the colorful contributions of native Americans and the many immigrant groups that have settled this country. Each section includes carefully researched and tested recipes.

Resources for Students

Dr. Beaumont and the Man with the Hole in His Stomach. S. Epstein and B. Epstein. New York: Coward, McCann & Geoghegan, 1978.

This book recounts for young readers the fascinating story of Dr. Beaumont's remarkable discoveries about digestion, made possible by an unusual shooting accident in 1822.

Food and Digestion. B. R. Ward. New York: Franklin Watts, 1982.

As part of The Human Body series, this book provides a clear overview of digestion. The text is enhanced by excellent color illustrations.

The Human Body. J. Miller. New York: Viking, 1983.

In twelve well-designed pop-up pages, Jonathan Miller gives young readers a realistic picture of parts of the body and how they relate to each other.

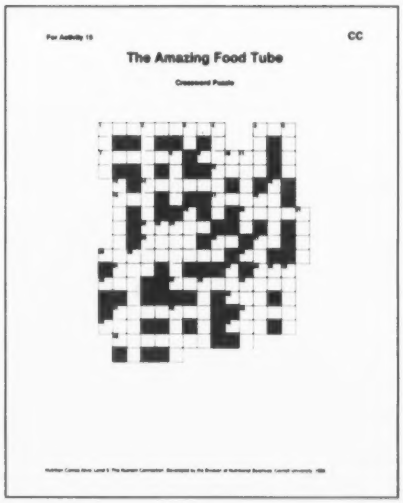
Many Friends Cooking: An International Cookbook for Boys and Girls. T. T. Cooper and M. Ratner. New York: Philomel Books and UNICEF, 1980.

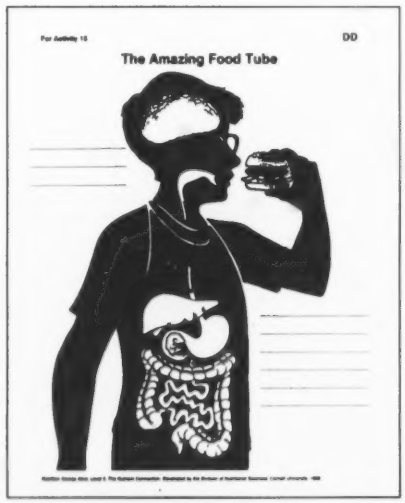
This engaging cookbook introduces young cooks to foods and customs of many lands. A code of one, two, or three spoons indicates the difficulty of each recipe.

When Hunger Calls. A. T. White and G. S. Lietz. Champaign, IL: Barrard, 1966.
This book details how all living things can take bits of the outside world and make them over into parts of themselves. The authors suggest that the quest for food has been the greatest inspiration for people to work, invent, dare the sea, and engage in commerce. They also contend that humans are able to survive in all parts of the world because their digestive systems allow them to eat such a wide variety of foods.

Your Stomach and Digestive Tract. H. S. Zim. New York: Morrow, 1973.
The author introduces young readers to the intricate digestive system by tracing each step in digestion. Along the way, many intriguing facts emerge. Dr. Zim has written several introductory books on physiology.

Tracking Food through the Tube





Advance Preparation

Have ready the poster, "The Amazing Food Tube."

Borrow a life-size anatomical torso or the pop-up book ***The Human Body*** (Resources, Section 3).

Bring in a 29-foot length of adding machine tape; a measuring stick; a large heavy-duty punching balloon or plastic bag to be filled with three pints of water; a measuring cup; a funnel; and a piece of terry cloth.

Make a model of a section of intestine using the instructions at the end of this activity.

Preview work sheets CC and DD. Copy ones suitable as evaluation activities for your class.

The Digestive Tract

Every one of us comes complete with an elaborate, built-in food processor called the digestive tract. It is so efficient that, under normal conditions, our bodies can digest up to 90 percent of the nutrients in the food we eat. By contrast, the elephant's digestive tract is so inefficient that it has to eat more than 700 pounds of vegetation every day.

Stretch out the 29-foot length of adding machine tape to dramatize how long the digestive tract is from end to end. Ask the students to name all the parts of the tract they can think of. How long do they think each part is? Write their answers on the board. Then, using the approximate lengths given below, have the students measure off each section and label it. (Note that these measurements change as a person grows and vary from one person to another.)

Mouth	6 inches
Esophagus	10 inches
Stomach	12 inches
Small intestine	20 feet
Large intestine	6 feet
Rectum	8 inches

The stomach is a baglike part of the food tube that resembles a large sausage when it is empty. But it can stretch to hold as much as three pints of food. Using the measuring cup and funnel, fill the balloon with three pints of water to illustrate the approximate size of a full stomach.

Display the poster, "The Amazing Food Tube," to show how the 29 feet of digestive tract are neatly tucked inside the body. Using the information on the poster, briefly describe what happens at each point along

the tract. Ask the following questions:

—Why is the small intestine called "small" when it is actually much longer than the large intestine?
(Because it is smaller in diameter.)

—Where is most of the food digested?
(In the small intestine.)

To show the digestive tract in three dimensions and in relation to other organs in the body, use a life-size anatomical torso or the pop-up book ***The Human Body.*** (continued)

How the Nutrients Pass out of the Digestive Tract

Once food has been thoroughly digested, the most amazing cells in the digestive system swing into action. They know immediately what nutrients the body needs, and they can absorb enough to nourish all the body's cells.

Hold up the piece of terry cloth. Explain that the remarkable cells you are talking about are inside little projections called **villi** that resemble the loops on the terry cloth. These projections cover the lining of the intestines, where they wave back and forth sorting through the digested nutrients. The nutrients are absorbed through the walls of the villi directly into **capillaries**, a network of tiny blood vessels. Fats are absorbed into **lymph vessels** (a separate network of vessels that transport fats to the bloodstream). Then the nutrients are ready to begin their journey to the cells.

If the lining of the intestines were smooth, there would be about 12 square feet of villi. But the lining isn't smooth. It is folded and rippled. If it were spread out completely flat, it would take up one-third of a football field. Have the class find out the dimensions of a football field and calculate what one-third of the area would be. Can the students figure out how many times larger that area would be than 12 square feet? (A football field measures 160′ x 300′.)

To give the class a better idea of what the intestinal lining looks like, show them the model you have made. Explain that it represents only a small section of the intestines. Ask the students to recall how long the small and large intestines actually are. What fraction of the total length would your model be? Then pull the cloth tube out to its full length to show that the lining is longer than the intestine itself because of all the folds and ripples. (The cardboard tube is used to give rigidity and define the length of the section. Normally, of course, the rippled lining would be on the *inside* of the intestine.)

Additional Activities

Tracking a Favorite Food through Digestion

Select a popular food such as a hamburger or a slice of pizza. Have the class check the nutrients the food contains by referring to the food composition table (Appendix 4). Then, using the poster, "The Amazing Food Tube," track the food through the digestive system pointing out where each nutrient is digested.

Evaluation

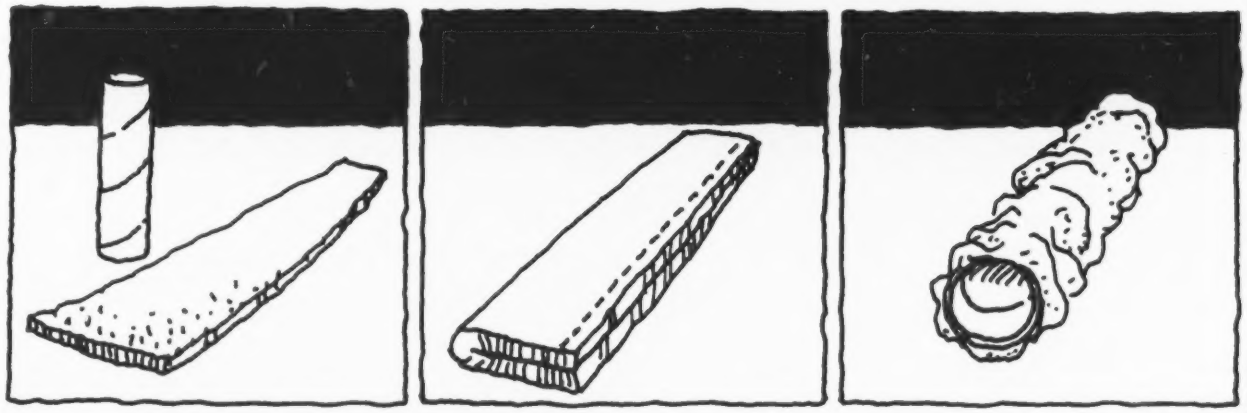
Use the word search and crossword puzzles (work sheet CC) to evaluate the students' understanding of the names and functions of the parts of the digestive tract. The puzzles vary in difficulty to accommodate different levels of interest and ability in the class. The starred items in the crossword puzzle relate to material covered in the activity. You may wait to use these puzzles after completing Activities 16, 17, and 18.

Have the students label the parts of the digestive system using the facsimile of the poster, "The Amazing Food Tube" (work sheet DD).

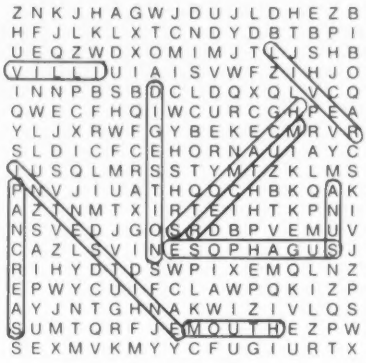
(continued)

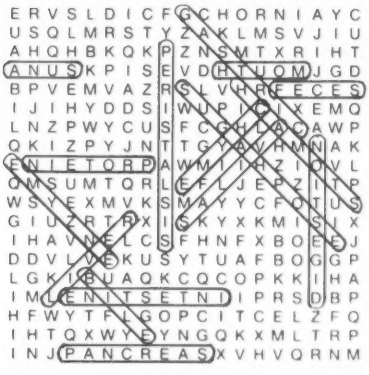
How to Make a Model Section of Intestine

Save a cardboard tube from a roll of paper towels. Then take a length of terry cloth approximately 36" x 7" and fold it lengthwise, loopy sides together. Stitch a 1/2" seam the full length of the fabric, leaving the ends open. You now have a long tube that will fit loosely around the cardboard tube. Insert the cardboard tube into the terry cloth tubing and gather up the cloth until it is the same length as the cardboard.

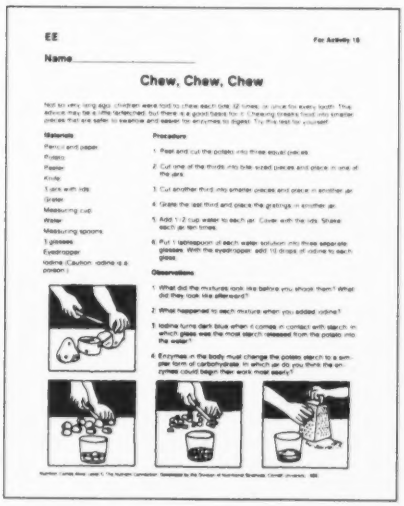


Answers to Work Sheet CC





The Great Grinding, Mashing, Churning, Splashing Food Machine



EE

Name_____

Chew, Chew, Chew

Not so very long ago, children were told to chew each bite 32 times, or once for every tooth. This advice may be a little farfetched, but there is a good basis for it! Chewing breaks food into smaller pieces that are safer to swallow and easier for enzymes to digest. Try this test for yourself.

Materials

Pencil and paper
Potato
Peeler
Knife
3 jars with lids
Grater
Measuring cup
Water
Measuring spoons
3 glasses
Eyedropper
Iodine (Caution: iodine is a poison.)

Procedure

1. Peel and cut the potato into three equal pieces.
2. Cut one of the thirds into bite-sized pieces and place in one of the jars.
3. Cut another third into smaller pieces and place in another jar.
4. Grate the last third and place the gratings in another jar.
5. Add 1-2 cup water to each jar. Cover with the lids. Shake each jar ten times.
6. Put 1 tablespoon of each water solution into three separate glasses. With the eyedropper, add 10 drops of iodine to each glass.

Observations

1. What did the mixtures look like before you shook them? What did they look like afterward?
2. What happened to each mixture when you added iodine?
3. Iodine turns dark blue when it comes in contact with starch. In which glass was the most starch released from the potato into the water?
4. Enzymes in the body must change the potato starch to a simpler form of carbohydrate. In which jar do you think the enzymes could begin their work most easily?

Nutrition Curricula Area Level 1, The Nutrient Connection. Translation by the Division of Nutritional Sciences, Cornell University, 1990.

Advance Preparation

Have ready the poster, "The Amazing Food Tube," to refer to throughout this activity.

Bring to class

- A stethoscope (or substitute a cardboard tube)
- A container of water and several paper cups
- A tube of toothpaste
- A floor cushion
- Bendable straws
- Crackers
- Flexible clear plastic tubing about 1 inch in diameter and 10 to 12 inches long
- A ball or marble that will fit snugly inside the tubing (a large "shooter" marble works well)
- Petroleum jelly

Copy work sheet EE and gather the materials listed.

Obtain a copy of the "First Aid for Choking" poster from the county health department or use the facsimile (Appendix 7).

Optional: Read "Choking on Food or a Foreign Object: Applying the Heimlich Maneuver" in ***Dr. Heimlich's Home Guide to Emergency Medical Situations*** (Resources, Section 3).

Bring in a one-ounce bottle of syrup of ipecac (from a pharmacy), a local telephone directory, and enough adhesive labels for the entire class. (The labels should be large enough for the students to write "Poison Control Center" and the telephone number.)

Listening to Digestion

The digestive system is a noisy, sloshy processor even when it isn't digesting food. Just the thought of food can start the digestive juices flowing. Then the stomach muscles start churning, and the rumbling begins. When the stomach is not filled with food, it is filled mostly with gas. The contractions of the stomach muscles squeeze the gas, causing the familiar "growls" or hunger pangs.

The class can use a stethoscope (or a cardboard tube) to listen to the sounds of swallowing and digestion. Have the students take turns listening to someone else's throat and esophagus while that person is swallowing water. Locate the stomach and intestines and listen to the sounds they make. Is there a difference?

Explain to the class that the *mechanical* part of digestion begins with the grinding, tearing, and mashing of the jaws and teeth, the pushing of the tongue, and the swallowing action of the throat muscles. Once food is in the stomach, it is churned and mashed some more until it is transformed into a thick, soupy mixture called **chyme**.

Peristalsis

Probably the most amazing mechanical action of all is peristalsis, which keeps food moving down the esophagus and through the digestive tract. It is a squeezing movement of the muscles that surround the walls of the entire food tube. It occurs in waves, pushing one lump of food after another. Demonstrate that the effect is similar to squeezing a tube of toothpaste.

Ask the students what they think would happen if they tried to swallow something when their bodies were upside down. Have two students stand on their heads on floor cushions while someone helps hold up their feet. Ask one student to sip

(continued)

water through a straw and the other to chew and swallow a cracker. When happens when they try to swallow?

They will soon discover that peristalsis defies gravity and works whether they are upside down or right side up. Thanks to peristalsis, astronauts can swallow their food even in the weightlessness of space.

To show how the muscles push food along, use the clear plastic tubing as the esophagus, the marble as a lump of food, and the petroleum jelly as the slippery mixture of mucus and saliva. Rub petroleum jelly on the marble and insert it in the tube. Then gently squeeze the tube behind the marble. Continue squeezing and releasing the tube until the marble reaches the other end.

What Chewing Does to Food

The teeth and jaws do the lion's share of the mashing job. To show that smaller pieces of food are easier for enzymes to digest than larger pieces, do work sheet EE in class. In this experiment, the students will cut a potato into progressively smaller pieces. They will then use iodine to test for the amount of starch each sample of potato has released. The grated potatoes should release the most starch into the water. Therefore the water from that sample should turn a darker blue when iodine is added.

When food isn't chewed enough in the mouth, it can be much harder to digest. It can also be harder to swallow. If large chunks of food get stuck in the throat, the airway may be blocked. Choking on food can be deadly.

First Aid for Choking

Choking seems to happen more often in social situations, perhaps because people are hurried or dis-

(continued)

tracted or attempting to carry on a conversation while eating. Eating places in New York State are required to post signs showing how to help a person who is choking. The poster diagrams a procedure called the Heimlich Maneuver, named after its inventor, Dr. Henry J. Heimlich.

The Heimlich Maneuver is a simple and effective treatment that even young people can learn. Before attempting the procedure in class, it may be helpful to read Dr. Heimlich's own description of the maneuver in his book, ***Dr. Heimlich's Home Guide to Emergency Medical Situations***.

First, describe to the class the telltale signs of choking. The setting is often the first clue—usually in or near an eating place.

1. A choking person *cannot breathe* and *cannot speak* because the airway is blocked, preventing air from reaching the vocal chords.
2. A choking person *turns blue* because oxygen cannot reach body tissues.
3. A choking person will *fall unconscious* because oxygen is not reaching the brain.

Teach the class the **Heimlich sign**—grasping the throat with the hand to indicate choking. Victims can use this sign to alert rescuers to apply the Heimlich Maneuver immediately.

Show the class the New York State Department of Health's "First Aid for Choking" poster (or the facsimile in Appendix 7). Using volunteers, demonstrate the Heimlich Maneuver, then have students pair up to practice the maneuver in class. It is very important to be gentle when practicing the Heimlich Maneuver in class. Doing the maneuver too energetically can cause injury, especially in small children. Stress that the fist must be held *below* the rib cage to avoid injury to the ribs and lungs. If you are unfamiliar or uncomfortable with teaching the Heimlich Maneuver, ask the school nurse, a Red Cross volunteer, or a parent who is a health professional to demonstrate the procedure.

Swallowing

Two "pipes" come together at the throat. One is the **esophagus**, which leads to the stomach. The other is the windpipe (or **trachea**), leading to the lungs. Most of the time, air goes to the lungs and food to the stomach with no problem. That is because every time food is swallowed, a flap of tissue called the **epiglottis** closes over the windpipe. Once in a while food manages to go down the wrong pipe. This may happen if a person inhales at exactly the same time he or she swallows and the flap doesn't close in time. Usually a few hearty coughs get the offending food back on the right track.

The Ups and Downs of Peristalsis

Explain that when the lining of the digestive tract is irritated by bacteria or a virus, or because of stress, peristalsis may speed up, causing **diarrhea**. When this happens, food moves through the tract too fast to be digested properly. If the problem isn't corrected quickly, the body could become dehydrated from losing valuable water and other important nutrients.

Lack of exercise, too little fiber in the diet, or distress can cause peristalsis to slow down. **Constipation** results, and feces accumulate in the large intestine.

Sometimes the brain sends a message to *reverse* peristalsis. A feeling of nausea usually signals that all is not well. Then the windpipe closes and the stomach muscles relax.

(continued)

Powerful contractions in the diaphragm and abdominal muscles force food back up the esophagus and out of the mouth.

Vomiting

This backward peristalsis happens (or feels as though it is going to happen) for many different reasons. See how many your students can think of. The following are some suggestions:

Having the flu

Being emotionally upset

Being nervous

Being afraid

Seeing or smelling something unpleasant

First Aid for Poisoning

Vomiting is also one of the body's best defenses against swallowed poisons. In some cases, as in food poisoning, the brain triggers the vomiting automatically. At other times, it may be necessary to induce vomiting as an antidote for poisoning.

Some of your students may babysit or plan to do so soon. Because 85 percent of poisonings involve children, it may be worthwhile to discuss what to do if a younger child in their care swallows a poison. They should be sure to have available:

A one-ounce bottle of syrup of ipecac, a nonprescription drug that is used to induce vomiting

The phone number of the nearest poison control center

Look in the telephone directory for the number of the nearest poison control center. It should be listed on the inside front cover. Have each student write the words "Poison Control Center" and the telephone number on an adhesive label to attach to a home phone.

Instruct the class that a safe first aid procedure is to give the victim one or two glasses of water to dilute the poison. *Then call the poison control center immediately. (If unable to get through, call a physician, hospital, or rescue unit.)* Be ready to report as much as possible about what was swallowed:

The name of the product

The manufacturer

Contents of the product, if listed on the label

How much was swallowed

If vomiting is indicated, the trained staff members can advise whether to administer syrup of ipecac or to induce gagging by tickling the back of the victim's throat with a blunt object.

The students should be told to follow the instructions of the poison control center and not to make medical judgments on their own. Some poisons, such as petroleum products, should not be vomited.

Additional Activity

Identifying Poisonous Products

Write the names of various household products on the board and have the students tell you which ones are poisons that should be kept out of the reach of children.

Evaluation

This activity should generate animated class discussions in which the children share their own experiences with choking and poisoning incidents. Their comments throughout the lesson will indicate how well they understand the concepts being taught. Another simple evaluation technique is to observe how well they perform the Heimlich Maneuver.

☞ **Food for Thought**

Why are mice especially vulnerable to poisoning?

Mice can't vomit.

Gut Reactions

Advance Preparation

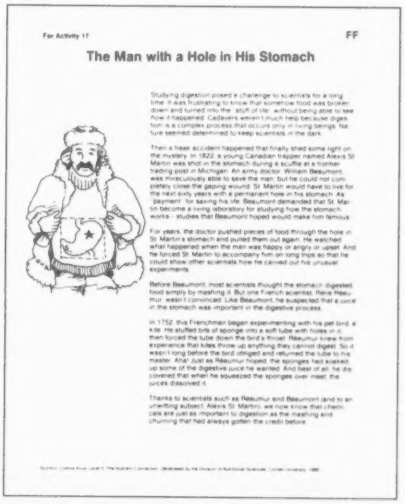
Have information sheet FF. If possible, borrow a copy of the book ***Dr. Beaumont and the Man with the Hole in His Stomach***. (Resources, Section 3) from the school or public library.

Bring to class

- 6 test tubes
- Test tube rack
- Raw egg white
- Saliva (yours or a student volunteer's)
- Dilute solution of hydrochloric acid from the high school chemistry department (or substitute chlorine bleach)
- Dishwashing detergent
- Water
- Yellow and red food coloring
- Rennet or junket tablet from the supermarket
- Powdered meat tenderizer (a natural enzyme, papaine) from the supermarket
- Soda crackers (preferably unsalted) for each student
- 2 jars with lids
- Salad oil
- Empty soup can
- Thimble

Copy work sheet GG and gather the materials listed.

Have ready the poster, "The Amazing Food Tube," to refer to as necessary throughout this activity.



For Activity 17 FF

The Man with a Hole in His Stomach

Studying digestion posed a challenge to scientists for a long time. It was frustrating to know that somehow food was broken down and turned into the stuff of life, without being able to see how it happened. Cadavers weren't much help because digestion is a complex process that occurs only in living beings. Nature seemed determined to keep scientists in the dark.

Then a freak accident happened that finally shed some light on the mystery. In 1822, a young Canadian trapper named Alexis St. Martin was shot in the stomach during a scuffle at a frontier trading post in Michigan. An army doctor, William Beaumont, was miraculously able to save the man, but he could not completely close the gaping wound. St. Martin would have to live for the next sixty years with a permanent hole in his stomach. As payment for saving his life, Beaumont demanded that St. Martin become a living laboratory for studying how the stomach works - studies that Beaumont hoped would make him famous.

For years, the doctor pushed pieces of food through the hole in St. Martin's stomach and pulled them out again. He watched what happened when the man was happy or angry or upset. And he forced St. Martin to accompany him on long trips so that he could show other scientists how he carried out his unusual experiments.

Before Beaumont, most scientists thought the stomach digested food simply by mashing it. But one French scientist, René Réaumur, wasn't convinced. Like Beaumont, he suspected that a juice in the stomach was important in the digestive process.

In 1752, this Frenchman began experimenting with his pet bird, a kite. He stuffed bits of sponge into a soft tube with holes in it, then forced the tube down the bird's throat. Réaumur knew from experience that kites throw up anything they cannot digest. So it wasn't long before the bird obliged and returned the tube to his master. After just as Réaumur hoped, the sponges had soaked up some of the digestive juice he wanted. And best of all, he also discovered that when he squeezed the sponges over meat, the juices dissolved it.

Thanks to scientists such as Réaumur and Beaumont (and to an unwilling subject, Alexis St. Martin), we now know that chemicals are just as important to digestion as the mashing and churning that had always gotten the credit before.

Chemicals That Digest Food

Read the story "The Man with a Hole in His Stomach" to the class. Talk about how much more difficult it was to learn about digestion before the invention of X-rays and modern medical testing procedures. How does the class feel about the way Dr. Beaumont and René Réaumur conducted their studies? If possible, have the students find out more about Beaumont's landmark discoveries (and the unusual doctor-patient relationship that made them possible) by reading ***Dr. Beaumont and the Man with the Hole in His Stomach***.

You and the class can do some demonstrations and experiments of your own to discover how chemical reactions aid in digestion.

First, list the following words on the board: **mucus**, **saliva**, **gastric juices**, **enzymes**, **bile**, **hormones**. To make these chemicals seem more real, prepare the following samples in test tubes and display them in a test tube rack.

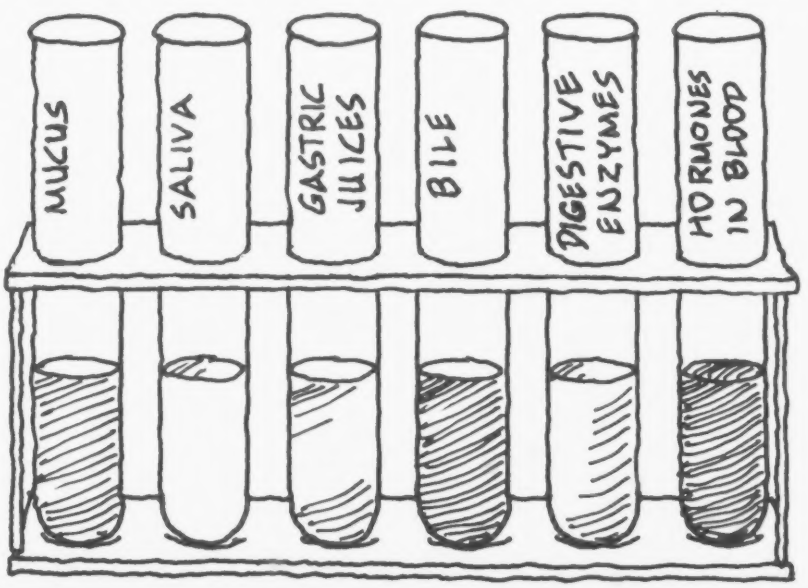
Test tube 1: raw egg white to represent slippery mucus

Test tube 2: about one tablespoon saliva

Test tube 3: a dilute solution of hydrochloric acid to represent gastric juices

Test tube 4: a solution of dishwashing detergent and water to repre-

(continued)



sent bile. (Add food coloring to make the solution a greenish-yellow.)

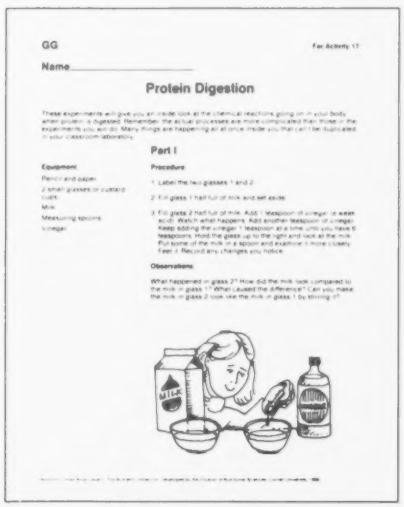
Test tube 5: rennet (junket) tablet or powdered meat tenderizer dissolved in a small amount of water to represent digestive enzymes

Test tube 6: red food coloring in water to represent hormones in the bloodstream

Using the information in the box, briefly explain what each chemical does.

Digesting Starch

Give each student a soda cracker. Ask them to chew their crackers slowly and thoroughly *without swallowing*. Does the taste change the more the cracker is chewed? (The cracker should taste sweeter as the enzyme ptyalin in saliva starts changing the starch in the cracker to sugar. This enzyme action stops when the cracker comes in contact with the acid in the stomach. No more starch is digested until the cracker reaches the small intestine.)


GG

Name_____

Protein Digestion

Part I

Equipment

Procedure

Observations

The body produces many different chemicals that take part in digestion.

Mucus, like that in your nose and mouth, helps make food slippery and also protects the lining of the digestive tract from scratchy foods and strong chemicals in the digestive juices.

Saliva moistens food and contains the enzyme ptyalin (tie' a lin) that starts the process of changing starch to sugar.

Enzymes are proteins that cause the breakdown of specific foods (such as ptyalin and amylase for starches, rennin and peptin for proteins, and lactase for the milk sugar lactose). The enzymes are not changed in these reactions. Some enzymes work only in an acid solution. Others work only in a basic (alkaline) solution.

Gastric juices are secreted in the stomach and small intestine. They contain enzymes and strong acids and bases (alkalis) that break down food.

Bile is secreted into the top of the small intestine to turn large drops of fat into tiny globules or droplets.

Hormones are chemical messengers in the blood. Certain hormones carry instructions between the brain and the digestive tract and from one part of the digestive tract to another.

Digesting Protein

Breaking proteins apart into amino acids is a complicated process. You can give the class some idea of how the process works by doing the experiments described in work sheet GG. Both enzymes required for the experiments are available at the supermarket—rennin in rennet or junket tablets and papaine in powdered meat tenderizer.

Rennin is an enzyme in a baby's stomach that partially digests milk. In adults, milk isn't digested until it reaches the small intestine, but the strong acid in the stomach curdles the milk. This curdling action causes the long protein molecules to unravel, making them easier for enzymes to digest.

Papaine is an enzyme found naturally in papayas, pineapple, and other tropical fruits. It is produced commercially as a meat tenderizer because it breaks down the tough connective tissue in meat during cooking. Although papaine is not a digestive enzyme in humans, it can be used to demonstrate the action enzymes have on proteins during digestion.

Work sheet GG is divided into three separate but related experiments. The recommended way to use this work sheet is to set up three work stations, one for each experiment. Divide the class into three groups and assign one group to each work station. Read through the work sheet and decide how to use it with your class.

In Part I, the vinegar curdles the milk. Once the protein is denatured by the acetic acid in vinegar, the process cannot be reversed. Therefore, stirring should have no effect on the curdled milk.

In Part II, the rennin will produce a custardlike texture in the milk. Both samples of milk may eventually solidify, but the change will occur more quickly in the warm milk.

In Part III, the papaine will partially dissolve the chicken. The smaller the pieces of chicken, the more

86 (continued)

completely they will dissolve. The chicken will also feel more slippery in the papaine mixture. Glasses 3 and 4 are the controls for the experiment.

It is important to point out that these three demonstrations are simplistic versions of what actually happens in the body. Acids, enzymes, and heat all contribute to the digestion of protein. To break protein down into amino acids in a laboratory, chemists must boil it in a strong acid solution for twenty-four hours at a temperature of at least 300 degrees Fahrenheit. The body does the job in about three hours at a temperature of less than 100 degrees Fahrenheit.

Digesting Fat

To demonstrate how bile turns fats into tiny droplets ready for enzyme action, use two jars with lids. Fill each jar half full of water and add about two tablespoons of salad oil. In one of the jars, add a small amount of dishwashing detergent.

(continued)

Shake both jars vigorously. Have the class compare what happens to the oil in each jar. (In the jar with the detergent, the fat is transformed into tiny droplets. In the other jar, the fat droplets are larger and quickly separate back out of the water.)

The Undigestibles

Explain that not everything we eat can be broken down by digestive juices. What doesn't get digested in the small intestine keeps moving into the large intestine. The mixture is quite liquid because all digestive reactions take place in water. The body secretes up to two gallons of water into the digestive tract each day. Once the water reaches the large intestine, much of it is reabsorbed through the intestinal wall in an internal recycling process.

The solid waste is mostly **fiber** from the tough cell walls of fruits, vegetables, and grains. This fiber (also called bulk or roughage) is important to a healthy body even though it is not digested. Fiber keeps wastes and poisons moving through the intestine and out of the body. It may also have other benefits in keeping the intestines healthy.

By the time the waste is ready to leave the body, it is still mostly water. It also contains the undigested fiber, digestive juices, dead cells, and bacteria from the digestive tract along with odds and ends such as bubble gum, chewed fingernails, and dirt.

Harmless bacteria live in the large intestine and are responsible for converting the waste matter to **feces** (from a Latin word for "dregs"). Hold up a soup can and a thimble as you explain about the bacteria. The body's helpful bacteria could fill the soup can. If you took away all of them that live in the intestines, the rest could fit comfortably into the thimble.

Evaluation

Make up a simple quiz in which the students match nutrients with definitions of the chemical reactions that help to break them down. For example:

1. Carbohydrates	A. Bile helps to break it into small droplets.
2. Protein	B. The part of food that isn't broken down by digestive juices.
3. Fiber	C. Enzymes and acid help to break it into amino acids.
4. Water	D. The only nutrient that is partly digested in the mouth.
5. Fat	E. This nutrient is absorbed into the body through the walls of the large intestine.

Answers: 1. D, 2. C, 3. B, 4. E, 5. A.

☞ Food for Thought

If the chemicals in our bodies are strong enough to digest our food, why don't they digest our stomachs and intestines, too?

The tough mucus lining of the stomach and intestines protects them from their own strong chemicals. Sometimes an overproduction of stomach acid can cause sores or ulcers to form in the lining of the stomach or upper part of the small intestine.

When All Is Not Well

Advance Preparation

Have ready the picture of the child with a stomachache (information sheet HH)

Bring to class

- A kitchen bulb baster
- Vinegar
- Baking soda (or soft drink)
- Lightweight, flexible balloon
- Soft drink bottle
- Measuring spoons and cups
- Granulated sugar
- Water
- Glass custard cup
- Package of active dry yeast

Have ready the poster, "The Amazing Food Tube," to refer to as necessary.

Optional: Copy work sheet CC to use as an evaluation.

Stomachache

The digestive tract is such a strong and forgiving part of our bodies that we rarely give it a second thought. But let something happen to upset it and we feel miserable all over.

Hold up the picture of the child with a stomachache. Ask the class to describe all the situations they can imagine to explain why she feels so miserable, such as:

- She ate something that wasn't easy to digest or made her sick.
- She is allergic to something she ate.
- She has the flu.
- She is nervous.
- She is upset about something.
- She has gas pains.

Use these suggestions to introduce a discussion of how health and emotions can affect digestion.

Emotions and the Stomach

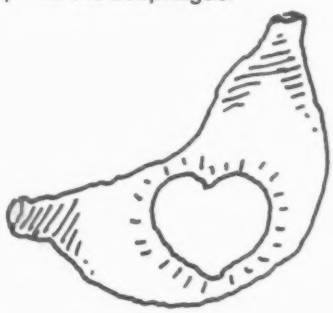
Ask the students to describe how they feel when they are excited, nervous, angry, afraid, or worried. Listen for comments such as:

- My stomach gets tied up in knots.
- I get butterflies in my stomach.
- I get a funny feeling in the pit of my stomach.

Why do we often link our emotions to our stomachs? Explain that the digestive system is very sensitive to emotions. The brain can react by sending signals to the digestive tract to work harder or to shut down completely. Sometimes powerful emotions such as anxiety or stress can cause an overproduction of stomach acid. If the condition goes on long enough, the extra acid may cause pits or **ulcers** in the stomach lining or the walls of the upper part of the small intestine. Ulcers are an extreme response to stress. Most people feel only a fluttery or aching sensation in their stomachs. Stress can also cause diarrhea by speeding up peristalsis and pushing food through the tract too quickly for all the nutrients and water to be absorbed properly. Any time the normal rhythm of digestion is upset, for whatever reason, food cannot be digested as efficiently and some nutrients may go unused.

Heartburn

Everyone suffers from a touch of heartburn now and then. Heartburn isn't really related to the heart. It is just a burning sensation *near* the heart that occurs when partly digested food and gastric juices back up into the esophagus.



You can demonstrate the cause of heartburn by putting water in a kitchen bulb baster and holding it bulb side down. Gently squeeze the bulb until the water squirts up into the tube and falls back. The lining of the esophagus is not as well

(continued)

equipped to cope with the acidic mixture as the stomach lining is. Therefore the esophagus becomes irritated and "burns."

Gas

Kids of all ages make jokes about gas because it can be embarrassing at times. They know creative ways to describe it and expel it, but chances are they don't know much about where it comes from.

Have everyone swallow a mouthful of air. What happens to it? Expect a chorus of burps in response. A little air is swallowed every time we eat. Sometimes a lot is swallowed when food is eaten too quickly, as children are prone to do. Kids find it amusing that in some cultures burping after a meal is considered a compliment to the cook. Perhaps this is true of some members of their own families.

Gas is also produced in chemical reactions in the digestive tract, especially when acids and bases mix. Try mixing vinegar and baking soda (or a soft drink) to demonstrate that gas is one product of this reaction. You might mix the two ingredients in a soft drink bottle and then quickly attach a balloon to the neck of the bottle. The gas should blow up the balloon. Shake the bottle to increase the output of gas. Gas bubbles in the body can distend the stomach and intestines, causing the familiar gas pains. Fortunately, enzymes help to keep these reactions in check.

A third way gas is formed is as a by-product when bacteria work on undigested food in the lower intestines. Beans are particularly notorious gas producers, mainly because they contain some sugars that humans cannot digest. Other foods that produce gas are broccoli, cabbage, cauliflower, and brussels sprouts. These vegetables leave undigested residue for bacteria to work on. Some people lack the enzyme lactase, which breaks down the milk sugar lactose. The bacteria in their small intestines ferment the milk

sugar to produce acids and gases that cause cramps and diarrhea. It is easier for these lactose-intolerant people to digest cheese, yogurt, and sour cream because the milk lactose has already been partly digested by fermentation.

You can use yeast to represent what happens when bacteria work on sugars and other undigested materials. Dissolve 2 teaspoons sugar in 1/2 cup lukewarm water in a glass custard cup. Stir in a package of active dry yeast. Let the yeast mixture sit undisturbed for 15 minutes. The foamy material that collects on top of the mixture is full of tiny bubbles of carbon dioxide gas produced by the yeast as it feeds on the sugar.

Appendicitis

Ask the students if they know anyone who has had an appendix removed. If anyone in the class has had appendicitis, ask that person to describe the symptoms. The appendix is a fingerlike projection near the top of the large intestine. It no longer has any function in humans and usually causes no trouble. But once in a while an appendix becomes blocked, trapping some decaying food material. The trapped material may eventually inflame the appendix so that it must be removed in an operation called an appendectomy.

Food Allergies

Most students will be able to relate a story about a real or assumed case of food allergy. Some people are indeed allergic to certain foods. They may get an upset stomach, headaches, hives, or diarrhea or have trouble breathing. Foods that cause allergies are as varied as the people who are allergic to them, but the most common ones are eggs, wheat, milk, potatoes, nuts, fish, tomatoes, and mushrooms.

Some people react immediately to the offending food, making it easy to see a cause-and-effect relationship. For others, tracking down the problem food is difficult because the symptoms are too general or appear several hours after the food is eaten. Since our diets contain so many processed foods, it is a challenge to identify the individual ingredients that can cause mild or even fatal reactions in sensitive people. People with food allergies have to be especially vigilant about reading food labels and demanding specific ingredient listings on all food products.

Evaluation

The class discussions that are an integral part of this activity should allow you to evaluate how well your students have grasped the basic concepts of the lesson. You may also use "The Amazing Food Tube" crossword puzzle (work sheet CC) after completing Activities 15, 16, 17, and 18.

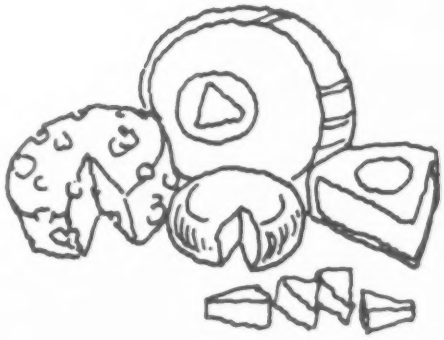
☞ **Food for Thought**

What are hunger pangs?

Hunger pangs are stomach contractions that occur when the stomach has been empty for a while. The gas and air in the stomach are squeezed against the stomach wall with every contraction, causing the familiar "growls."

30

It's the Nutrients That Count



Advance Preparation

Obtain a Japanese cookbook or restaurant menu.

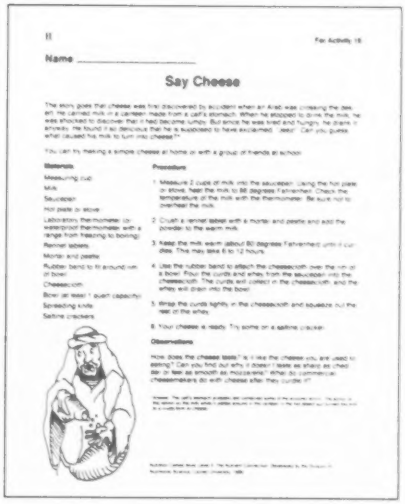
Have students bring in special family recipes.

Bring in a current telephone directory.

Find out what ethnic festivals are scheduled in your area and what arrangements are necessary to have your class attend.

Decide whether your class will have a tasting party. Arrange for the foods you will include in the tasting.

Copy work sheet II and gather the materials listed.



II For Activity 19

Name _____

Say Cheese

The story goes that cheese was first discovered by accident when an Arab was crossing the desert. He carried milk in a canteen made from a calf's stomach. When he stopped to drink, the milk he was shocked to discover that it had become curdy. But since he was tired and hungry, he drank it anyway. He found it so delicious that he is supposed to have exclaimed, "Jeez! Can you guess what caused his milk to turn into cheese?"

You can try making a simple cheese at home or with a group of friends at school.

Materials

Measuring cup
Milk
Saucepan
Hot plate or stove
Laboratory thermometer (or waterproof thermometer with a range from freezing to boiling)
Rennet tablets
Mortar and pestle
Rubber band to fit around can or bowl
Cheesecloth
Bowl at least 1 quart capacity
Spreading knife
Saltine crackers

Procedure

1. Measure 2 cups of milk into the saucepan. Using the hot plate or stove, heat the milk to 86 degrees Fahrenheit. Check the temperature of the milk with the thermometer. Be sure not to overheat the milk.
2. Crush a rennet tablet with a mortar and pestle and add the powder to the warm milk.
3. Keep the milk warm (about 80 degrees Fahrenheit) until it curdles. This may take 6 to 12 hours.
4. Use the rubber band to attach the cheesecloth over the rim of a bowl. Pour the curds and whey from the saucepan into the cheesecloth. The curds will collect in the cheesecloth, and the whey will drain into the bowl.
5. Wrap the curds tightly in the cheesecloth and squeeze out the rest of the whey.
6. Your cheese is ready. Try some on a saltine cracker.

Observations

How does the cheese taste? Is it like the cheese you are used to eating? Can you find out why it doesn't taste as sharp as cheddar or feel as smooth as mozzarella? What do commercial cheesemakers do with cheese after they curdle it?

All Tastes Are Not Alike

How can Eskimos thrive on musk oxen, arctic hare, fish eyes, seal liver, whale skins, and wild birds?

How can American soldiers survive in the wilderness on caterpillars, snakes, grasshoppers, and birds' eggs?

How can the Japanese enjoy pickled jellyfish, live shrimp, sea slugs, seaweed, and candied flower petals?

How can Westerners feast on lobsters and crabs yet refuse to eat grasshoppers, which are relatives of shellfish and a delicacy in many parts of Africa and Asia?

The human digestive system is remarkably adaptable. It can take all these foods in stride. In fact, it doesn't matter which foods we choose to eat as long as they contain the nutrients our cells need to grow and stay healthy. And those essential nutrients are the same for people the world around.

This activity is designed to give your class a chance to explore and celebrate the incredible variety of diets in the world that can provide the same essential nutrients.

Exploring for Nutrients the World Around

Explain that the food groups described in Activity 14 were developed for the typical American diet. The diets common in other countries don't necessarily fit into our food groups, yet all people need the same nutrients. And they manage to get them, as long as they choose carefully from the foods they have available.

Many Japanese people, for example, do not eat any milk products. Part of the reason is that Asian people are often unable to digest the lactose (a sugar) in milk. Americans, on the other hand, find it almost impossible to get enough calcium *without* drinking milk or eating cheese.

Ask your students how they think the Japanese might get the calcium they need without eating milk products. The following foods are good sources of calcium:

- Fish with edible bones, such as salmon and sardines
- Soybeans, kidney beans, and other dried beans, peas, and lentils
- Tofu (soybean curd)
- Broccoli, collards, turnip greens, and kale

Check a Japanese cookbook or restaurant menu. Which foods supply calcium?

(continued)

Over centuries of trial and error, people around the world have discovered how to create well-balanced diets with the foods they could grow or find locally.

Sharing a Special Food

Have your students bring in a recipe that has special meaning for them. It might be a recipe that has been passed down through the family, a recipe with a story behind it, an ethnic recipe that represents their family's cultural heritage, or a holiday recipe that is traditional in their family. Share the recipes in class and talk about why they are special. If possible, invite the parents and grandparents of the children to bring in special foods that reflect their cultural or ethnic backgrounds.

Researching Ethnic Foodways

Have your students check at home and in the library for ethnic cookbooks. Many of these cookbooks contain detailed descriptions of cultural food patterns along with the recipes. You might choose cultures according to those represented by the students in your class or by countries you are studying in social studies. Here are some questions to ask:

—What foods are most important in that country's cooking? Why are they important?

—What foods might be served in a typical day? How do they fit into the food groups described in Activity 14?
(Remember, the food groups are designed for the typical American diet. If the diet you are studying doesn't seem to fit, what food groups are underrepresented? What other foods in this diet might supply the same nutrients?)

—How many meals are served during the day? What special customs are associated with these meals? Are there certain ways the food is served or the table prepared?

—Are there special ways the food is prepared?
(Stir-frying, for example, is common in Chinese cooking.)

—Who prepares the food?

—What dishes and utensils are used to prepare and serve the food?

—Are particular foods served at special celebrations or holidays?

Exploring the Ethnic Variety in Your Community

Almost every community has ethnic roots. Find out what they are in your area. You might start by checking the restaurant section in the yellow pages of your local telephone directory.

—How many ethnic restaurants can you find?

—What national foods seem to be the most popular?

—Do many people of that ethnic background live in your community?

—If not, why do you think the foods have become popular?
(Pizza parlors and Mexican restaurants were rarely found in small towns in New York even twenty-five years ago. Now there is hardly a town that doesn't have at least one nearby.)

—Are there ethnic food stores or factories near you? If so, these are good places to interview ethnic members of the community.

Watch for ethnic festivals held in your area. Food is almost always a central part of these celebrations. You may want to plan a class trip to one of these festivals. If there are no festivals you can attend, the class may be able to plan its own in conjunction with a social studies unit.

Organizing a Tasting Party

Trying new foods is always more fun when it is done in a party atmosphere. You can have a party to sample each child's favorite family or ethnic recipe or use one of the following ideas.

Have a fruit and vegetable party with as many unusual examples of produce as your students can find in your local market. Find out which cultures are most familiar with using the produce you select. Try mangoes, guavas, plantains, kiwis, gooseberries, artichokes, Jerusalem artichokes, red cabbage, Chinese cabbage, snow peas, mandarin oranges, pomegranates, and a variety of melons. If the items are out of season or unavailable fresh, check the canned and frozen food sections of a supermarket.

Sample breads from around the world. Your choices might include saffron buns from Sweden, soda bread from Ireland, challah from Israel, scones from Scotland, kringle from Denmark, babka from Poland, brioche from France, and rice cakes from Japan. Recipes for these breads are available in international cookbooks. You can also choose from an assortment of bakery breads

(continued)

such as French or Italian loaves, Middle Eastern pita, English pumpernickel, Swedish rye, and Russian or German black bread. Be sure to talk about the grains used to make the different breads and why they are used.

Cheese is another widely used food. Many cultures have invented cheeses. Your class might like to sample

Mozzarella or Bel Paese from Italy

Bleu from Denmark

Brie or Camembert from France

Cheddar or Stilton from England

Edam or Gouda from Holland

Gruyère or Emmenthaler from Switzerland

Muenster from Germany

Cream cheese or Monterey Jack from the United States

With such a tremendous variety in cheeses, it is hard to believe they all begin in much the same way. Most are made from cow's or goat's milk (although any milk can be used and probably has been somewhere by somebody). The action of either rennet or lactic acid on the milk causes the casein (or curds) to separate from the whey. The curing process, which follows this initial curdling, accounts for the diversity of flavors and textures. Variations in size, shape, and color add their own stamp of individuality.

Compare all these cheeses with a simple cheese you can make in class. Work sheet II tells you how.

Cheesemaking is an especially fitting project for a study of digestion. You can point out that the action of the enzyme rennin in the curdling step is very similar to the first stages of digestion that milk goes through in a baby's stomach. The recipe on work sheet II produces about one-half cup cheese from the two cups of milk. You will need to make more than one batch if the entire class will be doing the cheese project.

Pancakes are another example of a food with many cultural variations. Have your class research the stories behind these international favorites:

Russian blini

French crepes

(continued)

Indian chapatis

Mexican tortillas

Scottish bannocks

Irish boxty-on-the-pan

Jewish latkes

Dutch babies

Italian cannelloni

Chinese egg rolls

Then, of course, there are the regional variations in our own country—New England johnnycakes and flannelcakes, loggers' flapjacks, or old-fashioned hoecakes, to name a few. As an added attraction, recreate the famous Pancake Race that has been a tradition in Olney, England, on Shrove Tuesday (the day before Ash Wednesday) for more than five hundred years.

Additional Activities

For students who would like to learn more, here are some independent projects.

Food Taboos

Almost every culture has certain well-established food taboos. The Orthodox Jewish law that forbids serving meat and dairy foods at the same meal may be familiar. See how many others you can discover. ***The Foodbook*** by James Trager (Resources, Section 3) is an excellent source of information on taboos.

Unusual Foods

Find out some of the more unusual foods people eat in other parts of the world. Do you think that people in other cultures might be amazed by what you are willing to eat?

Unfamiliar Nutrient Sources

Earlier we looked at ways the Japanese get calcium without depending on milk products as Americans do. What other examples of unfamiliar nutrient sources can you find? Here are some questions to get you started:

—Citrus fruit is the most important source of vitamin C in the United States. Yet citrus fruit cannot grow in cold climates and cannot be shipped everywhere in the world. How do isolated Alaskan Eskimos get vitamin C in their diets?

—Humans can make vitamin D in a chemical reaction that takes place under the skin, but this reaction requires sunlight. Many places in the world have no sunlight for months at a time. How do the people in these places get enough vitamin D?

Again, ***The Foodbook*** is a good resource for this information.

Evaluation

Make a list of twenty foods that are important in other cultures. Base your choices on the cultures you have studied in class. Stick to simple foods, not complicated mixtures. Have the students categorize the foods into the basic food groups covered in Activity 14. You may do a similar evaluation with a typical day's food intake of an ethnic group the class has studied.

Cornell Cooperative Extension

ALBANY
518-765-3550

Cooperative Extension
Albany County Resources
Development Center
Martin Road, R.D. 2, Box 131
Voorheesville, NY 12186

ALLEGANY
716-268-7644

Cooperative Extension
County Rd. 48
R.D. 1, Box 226
Belmont, NY 14813

BROOME
607-772-8953

Cooperative Extension
Farm, Home and 4-H Center
840 Front Street
Binghamton, NY 13905

CATTARAUGUS
716-699-2377

Cooperative Extension
Cooperative Extension Center
Parkside Drive
Ellicottville, NY 14731

CAYUGA
315-255-1183

Cooperative Extension
Farm, Home and 4-H Center
248 Grant Avenue
Auburn, NY 13021

CHAUTAUQUA
716-664-9502

Cooperative Extension
Chautauqua County Agricultural Center
R.D. 2
Turner Road, Box 341 A
Jamestown, NY 14701-9608

CHEMUNG
607-734-4453

Cooperative Extension
425 Pennsylvania Ave.
Elmira, NY 14904

CHENANGO
607-334-2634

Cooperative Extension
Farm, Home and 4-H Center
99 North Broad Street
Norwich, NY 13815

CLINTON
518-561-7450

Cooperative Extension
Old Court House Building
Margaret Street
Plattsburgh, NY 12901

COLUMBIA
518-828-3346

Cooperative Extension
Extension Center
Route 66, R.D. #1
Hudson, NY 12534

CORTLAND
607-753-5077

Cooperative Extension
County Office Building
60 Central Avenue
P.O. Box 5590
Cortland, NY 13045

DELAWARE
607-865-6531

Cooperative Extension
P.O. Box 184, NYS Rt. 10
Hamden, NY 13782

DUTCHESS
914-677-5061

Cooperative Extension
P.O. Box 259, Rt. 44
Millbrook, NY 12545

ERIE
716-652-1170

Cooperative Extension
Cooperative Extension Center
21 South Grove Street
East Aurora, NY 14052

ESSEX
518-962-8241

Cooperative Extension
Agricultural Center
Sisco Street
Westport, NY 12993

FRANKLIN
518-483-6767

Cooperative Extension
Cooperative Extension Headquarters
11 Brewster Street
Malone, NY 12953

FULTON
518-765-6441

Cooperative Extension
57 East Fulton Street
Gloversville, NY 12078

GENESEE
716-343-3040

Cooperative Extension
Cooperative Extension Center
420 East Main Street
Batavia, NY 14020

GREENE
518-622-9820

Cooperative Extension
Extension Center
HCR #3, Box 906
Cairo, NY 12413

HAMILTON
518-548-6191

Cooperative Extension
P.O. Box 112 (Courthouse)
Lake Pleasant, NY 12108

HERKIMER
315-866-7920

Cooperative Extension
107 Court St.
Herkimer, NY 13350

JEFFERSON
315-788-8450

Cooperative Extension
223 J.B. Wise Place
Watertown, NY 13601

LEWIS
315-376-6551

Cooperative Extension
Post Office Box 72
5229 Dayan St.
Lowville, NY 13367

LIVINGSTON
716-658-2131

Cooperative Extension
158 South Main Street
Mount Morris, NY 14510

MADISON
315-684-3001

Cooperative Extension
Farm and Home Center
Eaton Street, P.O. Box T
Morrisville, NY 13408

MONROE
716-461-1000

Cooperative Extension
Cooperative Extension Center
249 Highland Avenue
Rochester, NY 14620

MONTGOMERY
518-853-3471

Cooperative Extension
Old Court House
Fonda, NY 12068

NASSAU
516-454-0900

Cooperative Extension
Plainview Complex—Bldg. J.
1425 Old Country Road
Plainview, NY 11803

NIAGARA
716-433-6773

Cooperative Extension
Farm and Home Center
4487 Lake Avenue
Lockport, NY 14094

ONEIDA
315-736-3394

Cooperative Extension
R.R. #1, Box 126
2nd Street
Oriskany, NY 13424-9998

ONONDAGA
315-424-9485

Cooperative Extension
Cooperative Extension Center
1050 West Genesee Street
Syracuse, NY 13204

ONTARIO 716-394-3977	Cooperative Extension Cooperative Extension Center 480 North Main Street Canandaigua, NY 14424
ORANGE 914-343-5979	Cooperative Extension Farm and Home Center 239 Wisner Avenue Middletown, NY 10940
ORLEANS 716-589-5561	Cooperative Extension P.O. Box 150 20 S. Main St. Albion, NY 14411
OSWEGO 315-963-7286	Cooperative Extension Cooperative Extension Headquarters Main Street Mexico, NY 13114
OTSEGO 607-547-2536	Cooperative Extension 123 Lake Street Cooperstown, NY 13326
PUTNAM 914-628-0454	Cooperative Extension 179 East Lake Boulevard Mahopac, NY 10541
RENSSELAER 518-270-4000	Cooperative Extension County Court House Congress and 2nd Sts. Troy, NY 12180
ROCKLAND 914-638-5500	Cooperative Extension 62 Old Middletown Road New City, NY 10956-2737
ST. LAWRENCE 315-379-2311	Cooperative Extension University Shopping Center 125 Main St. East Canton, NY 13617
SARATOGA 518-885-8995	Cooperative Extension 50 West High Street Ballston Spa, NY 12020
SCHENECTADY 518-372-1622	Cooperative Extension 615 State St. Schenectady, NY 12305
SCHOHARIE 518-234-4303	Cooperative Extension 41 South Grand Street Cobleskill, NY 12043
SCHUYLER 607-535-7466	Cooperative Extension Rural-Urban Center 208 Broadway Montour Falls, NY 14865
SENECA 315-539-9254	Cooperative Extension Farm, Home and 4-H Center 321 East Williams Street Waterloo, NY 13165
STEUBEN 607-776-7666	Cooperative Extension County Office Building 119 East Steuben St. Bath, NY 14810
SUFFOLK 516-727-7850	Cooperative Extension 246 Griffing Avenue Riverhead, NY 11901
SULLIVAN 914-292-5250	Cooperative Extension P.O. Box 191 (59 N. Main St.) Liberty, NY 12754
TIOGA 607-687-4020	Cooperative Extension 56 Main Street Owego, NY 13827
TOMPKINS 607-272-2292	Cooperative Extension Cooperative Extension Center 225 South Fulton Street Ithaca, NY 14850
ULSTER 914-338-3494	Cooperative Extension Extension Headquarters P.O. Box 3545 (74 John St.) Kingston, NY 12401
WARREN 518-623-3291	Cooperative Extension Schroon River Road HCR 02, Box 23B Warrensburg, NY 12885
WASHINGTON 518-747-2861	Cooperative Extension County Office Building Annex Lower Main Street Hudson Falls, NY 12839
WAYNE 315-483-6918	Cooperative Extension P.O. Box 217 (County Rd. 143 and Rt. 14N) Alton, NY 14413
WESTCHESTER 914-682-3074	Cooperative Extension 214 Central Avenue White Plains, NY 10606
WYOMING 716-786-2251	Cooperative Extension 401 North Main Street Warsaw, NY 14569
YATES 315-536-3381	Cooperative Extension County Office Building 110 Court Street Penn Yan, NY 14527

New York Offices of Cornell Cooperative Extension, including Expanded Food and Nutrition Program sites (EFNEP):

Administrative Office 213-340-2900	Cornell Cooperative Extension 15 East 26th St., 5th Floor New York, NY 10010-11565
Brooklyn Center 718-237-0920	100 Clinton Street, 2nd Floor Brooklyn, NY 11201-4203
Bedford Stuyvesant EFNEP 212-783-2722	Stark Bldg., 5th Floor 1360 Fulton Street Brooklyn, NY 11216-2606
Bronx EFNEP 212-583-7770	2021 Grand Concourse, Room 602 Bronx, NY 10453-4317
Brownsville EFNEP 718-385-0233	444 Hopkinson Ave., 1st Floor Brooklyn, NY 11212-1542
Lower East Side EFNEP 212-260-6300	107 Suffolk, Rm. 210 New York, NY 10002-3305
Queens EFNEP 212-526-3490	161-10 Jamaica Avenue, Room 216 Jamaica, NY 11432-6149
Staten Island EFNEP 718-447-2600	28 Bay Street Staten Island, NY 10301-2511
Upper Manhattan EFNEP 212-923-2400	4250 Broadway, Room 7 New York, NY 10033-3708

Dairy Council Offices in New York State

Dairy, Food, and Nutrition Council

Syracuse (315) 475-2721,
Headquarters
(counties served: Cayuga, Cortland, Hamilton, Herkimer, Jefferson, Lewis, Madison, Oneida, Onondaga, Oswego, Seneca, St. Lawrence)
472 South Salina Street, Suite 101
Syracuse, NY 13202-2401

Arkport (607) 295-7222
(counties served: Allegany, Cattaraugus, Steuben)
R.D. #1, Box 220A
Ellis Hill Road
Arkport, NY 14807

Binghamton (607) 724-7598
(counties served: Broome, Chemung, Chenango, Delaware, Otsego, Schuyler, Tioga, Tompkins, Yates)
834 Front Street
Binghamton, NY 13905

Latham (518) 785-5441
(counties served: Albany, Clinton, Columbia, Essex, Franklin, Fulton, Greene, Montgomery, Rensselaer, Saratoga, Schenectady, Schoharie, Warren, Washington)
Commerce Building
678 Troy-Schenectady Road
Latham, NY 12110

Poughkeepsie (914) 452-5630
(counties served: Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster)
316 Main Mall
Poughkeepsie, NY 12601

Dairy Council of Niagara Frontier Area (716) 634-1080
(counties served: Erie, Genesee, Niagara, Orleans, Wyoming)
2451 Wehrle Drive
Buffalo, NY 14221

Dairy Council of Metropolitan New York (212) 682-7961
(counties/boroughs served: Bronx, Brooklyn, Manhattan, Queens, Staten Island, Nassau, Suffolk, Westchester)
60 East 42nd Street, Room 2446
New York, NY 10165

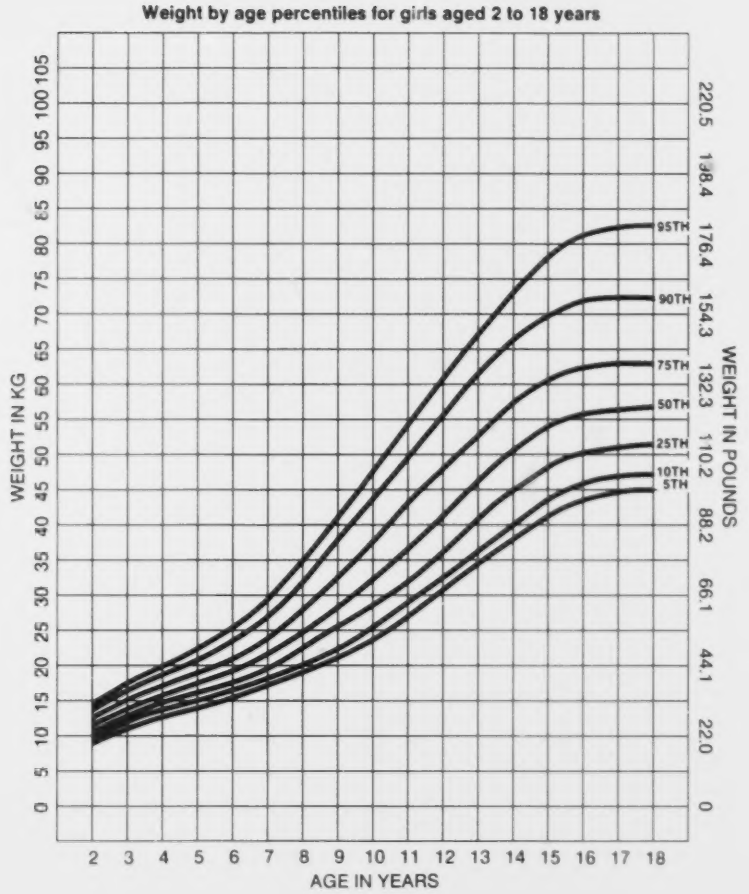
Dairy Council of Rochester Area (716) 461-2880
(counties served: Livingston, Wayne, Monroe, Ontario)
Carnegie Place
247 No. Goodman
Rochester, NY 14607

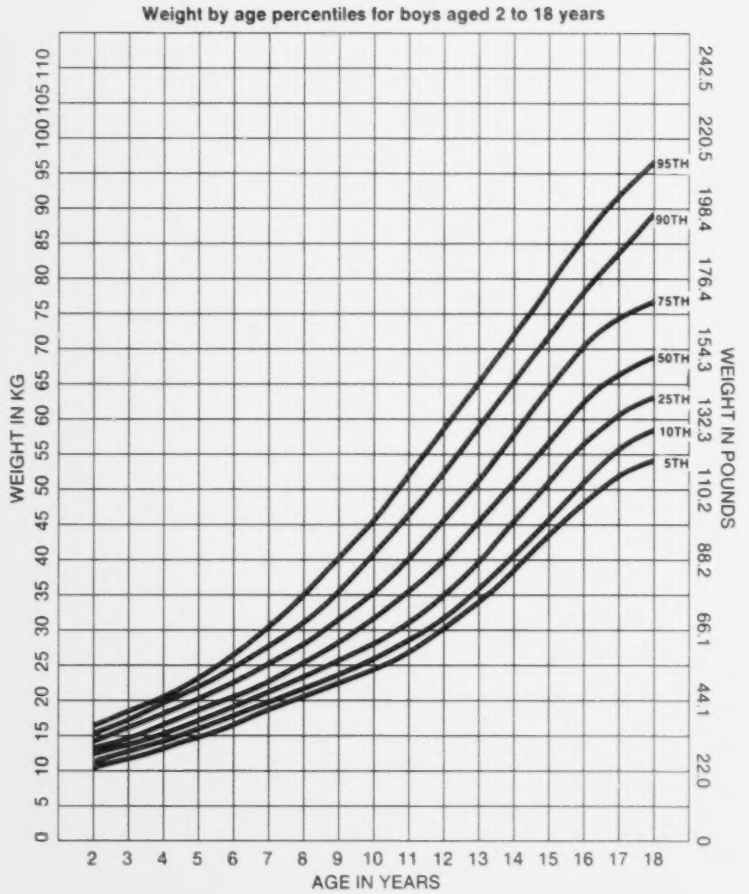
Dairy and Nutrition Council, Mideast (814) 868-1714
(county served: Chautauqua)
Park Place, Suite 11
1545 W. 38th Street
Erie, PA 16508

Health and Nutrition Regional Network

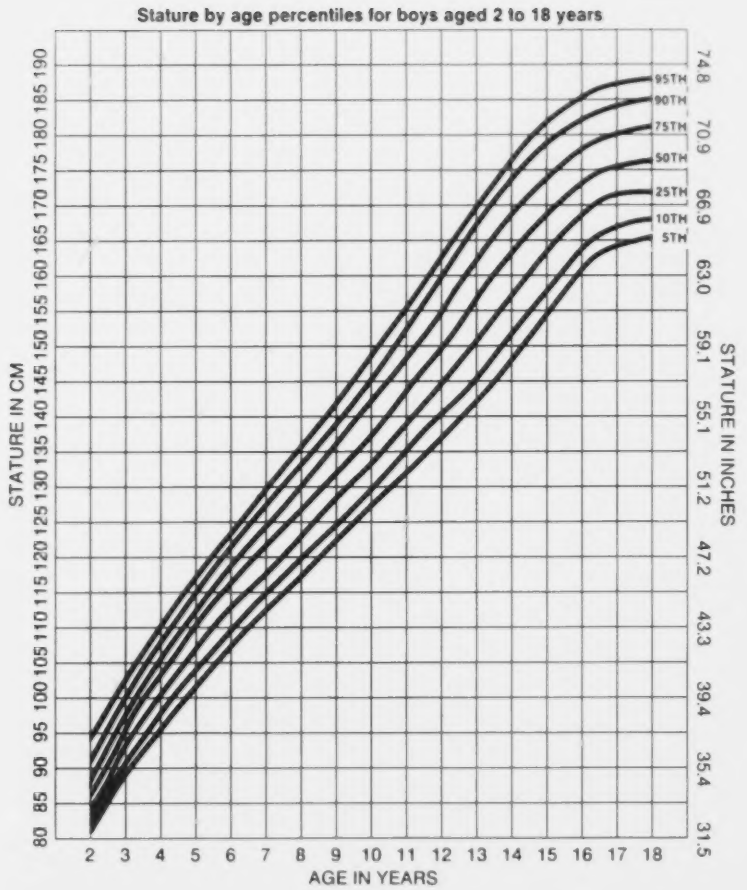
Coordinator	Geographic Area Served
Regional Health and Nutrition Coordinator St. Lawrence-Lewis County BOCES A. A. Kingston Middle School Potsdam, NY 13676	Region I: Counties of Allegany, Cattaraugus, Cayuga, Chautauqua, Clinton, Erie, Essex, Franklin, Genesee, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Niagara, Oneida, Onondaga, Ontario, Orleans, Oswego, St. Lawrence, Seneca, Wayne, Wyoming, Yates
Regional Health and Nutrition Coordinator Ulster County BOCES 175 Route 32 North New Paltz, NY 12561	Region II: Counties of Albany, Broome, Chemung, Chenango, Columbia, Cortland, Delaware, Dutchess, Fulton, Greene, Montgomery, Orange, Otsego, Putnam, Rensselaer, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Steuben. Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Westchester
Regional Health and Nutrition Coordinator Suffolk 3 BOCES Long Acre School Sarina Drive Commack, NY 11725	Region III: Counties of Nassau and Suffolk and New York City (five boroughs)

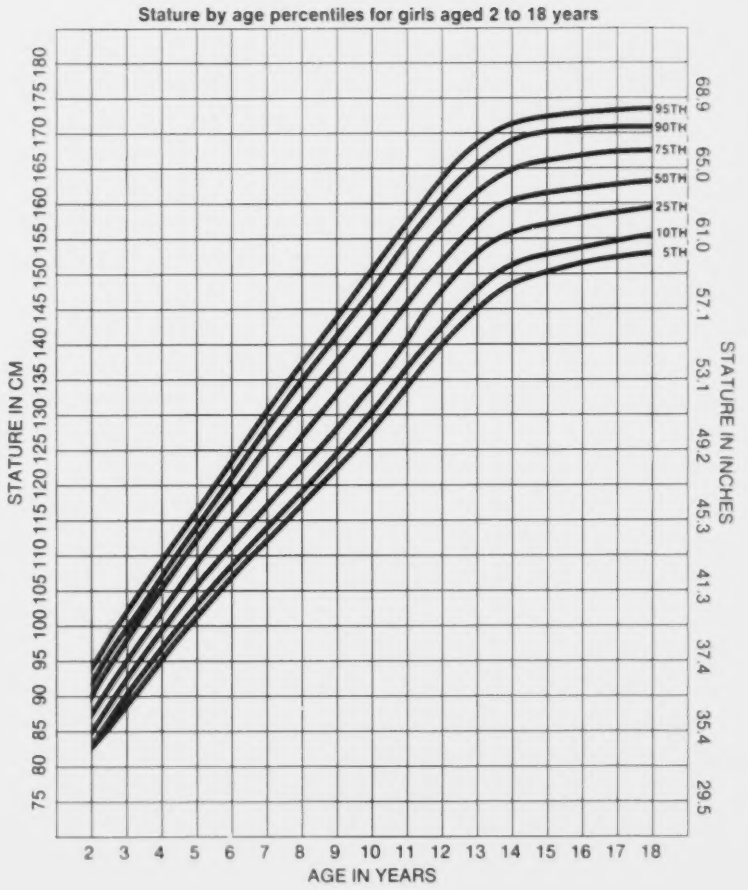
Growth Charts for Children Aged 2 to 18 Years





Growth Charts for Children Aged 2 to 18 Years





National Center for Health Statistics

Food Composition Table

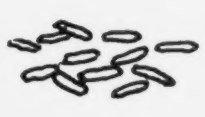
Food	Amount g	Calories	Water %	Carbohydrate g	Fat g	Protein g	Calcium mg	Iron mg	Vitamin A IU	Thiamin mg	Riboflavin mg	Niacin mg	Vitamin C mg
Almonds, shelled, chopped	1/2 cup (65 g)	388	5	13	35	12.0	152	3.1	—	16	.6	2.3	Trace
Apple	1 med. (138 g)	80	84	20	1	3	10	.4	124	.04	.03	.1	6
Bagel	1 (55 g)	165	32	28	2	6.0	9	1.2	30	14	.1	1.2	—
Banana	1 med. (119 g)	101	76	26	1	1.3	10	.8	226	.06	.07	.8	12
Beans, baked, in pork and tomato sauce	1/2 cup (128 g)	156	71	24	4	7.8	69	2.3	166	.1	.04	.8	3
Beans, green	1/2 cup (63 g)	16	92	4	—	1.0	31	.4	338	.04	.06	.3	8
Beans, lima	1/2 cup (95 g)	94	64	25	1	6.5	40	2.1	238	.15	.09	1.1	14
Bread, white	1 slice (23 g)	61	35	12	1	2.0	19	.6	—	.09	.06	.8	—
Bread, whole wheat	1 slice (25 g)	55	36	12	1	2.4	22	.5	—	.06	.03	.6	—
Broccoli	1/2 cup (78 g)	20	91	4	—	2.4	68	.6	1938	.07	.16	.6	70
Cake, devils food	1/16 of 9" cake (69 g)	234	24	40	8	3.0	41	.06	104	.02	.06	.2	—
Candy bar, milk chocolate	1 oz. (30 g)	147	1	16	9	2.2	65	.3	77	.02	.1	.1	—
Cantaloupe	1/4 med (238 g)	29	91	10	—	.7	—	.4	3273	.04	.03	.6	32
Carrot sticks	5" carrot (50 g)	21	88	5	—	.6	19	.4	5500	.03	.03	.3	4
Cauliflower	1/2 cup (90 g)	13	93	3	—	1.4	13	.4	36	.05	.05	.4	33
Celery sticks	8" stalk (40 g)	10	94	2	—	.5	22	—	136	—	—	—	5
Cereal, corn flakes	3/4 cup (18 g)	72	4	15	—	1.5	3	.3	—	.08	.02	.4	—
Cheese, American	1 oz. (30 g)	104	39	—	9	6.0	172	—	236	—	.1	—	—
Cheese, Swiss	1 oz. (30 g)	103	37	1	8	8.0	268	—	206	—	.09	—	—
Chicken, fried	3 oz. (90 g)	201	58	1	5	26.0	12	2.0	148	.06	.38	5.9	—
Chili con carne with beans	1 cup (255 g)	333	72	31	16	18.8	80	4.3	150	.08	.18	8.8	—
Corn	1/2 cup (83 g)	70	77	15	.5	2.2	4	.4	291	.02	.04	.8	3
Egg white, raw	1 from large egg (33 g)	15	88	Trace	Trace	3.0	4	Trace	—	Trace	.09	Trace	—
Fish sticks, breaded, cooked	3 (84 g)	150	66	6	9	15.0	9	.3	—	.03	.06	1.5	—
Hot dog	1 (56 g)	170	57	1	15	7.0	3	.8	—	.08	.11	1.4	—
Hot dog roll	1 (40 g)	119	31	21	2.0	3.3	30	.8	—	.16	.1	1.3	—
Lettuce, raw	2 inner leaves (15 g)	Trace	95	Trace	Trace	Trace	5	.3	150	.01	.01	Trace	1

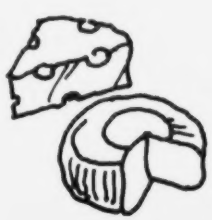
Food	Amount g	Calories	Water %	Carbo-hydrate g	Fat g	Protein g	Calcium mg	Iron mg	Vitamin A IU	Thiamin mg	Riboflavin mg	Niacin mg	Vitamin C mg
Margarine	2 T. (14 g)	100	16	Trace	12	Trace	3	Trace	470	Trace	Trace	Trace	—
Milk, chocolate	1 cup (250 g)	213	82	26	8.0	8.5	278	.5	325	.08	.4	.3	3
Milk, skim	1 cup (245 g)	77	91	12	—	7.3	304	.1	500	.10	.48	.2	4
Milk, whole	1 cup (244 g)	145	88	11	8.0	7.3	304	.1	250	.1	.48	.2	4
Milk shake, chocolate	1-1/2 cup (330 g)	391	72	69	9.0	12.1	376	.7	688	.11	.56	.5	3
Mushrooms, raw, chopped	1/2 cup (35 g)	10	90	1.5	Trace	1.0	2	.3	Trace	.04	.16	1.5	—
Oatmeal	1/2 cup (120 g)	66	87	12	1.0	2.4	11	.7	—	.1	.02	.1	—
Okra	1/2 cup (41 g)	12	91	3	—	.9	39	—	208	.06	.08	.4	9
Orange	1 med (131 g)	65	86	16	—	1.3	54	.5	263	.13	.05	.5	66
Peanuts	1/4 cup (36 g)	211	2	7	18.0	9.4	27	—	—	.12	.05	6.2	—
Peanut butter	1 oz. (2 T.) (30 g)	186	2	6	16.0	8.9	20	.6	—	—	.04	5.0	—
Pear	1 med. (164 g)	101	83	25	1.0	1.2	—	.5	—	.03	.07	—	7
Peas, green	1/2 cup (80 g)	54	82	10	—	4.1	15	1.5	480	.22	.07	1.4	10
Pie, apple	1/6 of 9" pie (157 g)	403	48	59	17.0	3.5	13	1.1	47	.15	.13	1.7	2
Pizza, cheese	1/4 of 14" pie (146 g)	354	45	54	10.0	18.0	332	2.7	945	.38	.49	3.8	12
Potato, baked	1 med. (142 g)	132	75	30	—	3.7	13	1.0	—	.14	.06	2.4	28
Potato chips	20 chips (40 g)	228	2	20	16.0	2.2	16	.4	—	.08	.02	2.0	6
Raisins	4-1/2 T. (36 g)	123	18	23	—	1.1	26	—	—	.05	.03	—	—
Rice, white, enriched long grain, cooked	1/2 cup (103 g)	113	73	25	Trace	4.0	11	.9	—	.12	.01	1.1	—
Roast beef	3 oz. (90 g)	182	62	—	7.0	25.5	11	3.2	17	.04	.2	3.9	—
Soft drink	1 cup (246 g)	96	90	25	—	—	—	—	—	—	—	—	—
Soup, chicken noodle	1 cup (240 g)	59	95	8	1.0	3.2	9	.5	45	.02	.02	.02	—
Strawberries	1/2 cup (75 g)	28	90	7	.5	.5	16	0.7	45	.02	.05	.4	44
Taco, beef	1 (83 g)	186	NA	14	8	15.0	120	2.6	120	.1	.16	3.0	.2
Tofu (soybean curd)	3-1/2 oz. (100 g)	72	NA	2	4	8.0	128	1.9	—	.06	.08	.1	—
Tomato, raw	1 med. (135 g)	22	94	6	—	1.1	16	.5	1100	.06	.04	.9	28
Tuna, canned in oil	3 oz. (90 g)	168	61	—	7	24.5	7	1.6	68	.04	.1	10.1	—
Watermelon	4" x 8" (926 g)	110	93	27	1	2.0	30	2.1	2510	.13	.13	.9	30
Yogurt, fruit flavored	1 cup (227 g)	225	75	42	3	9.2	290	.2	90	.07	.4	.22	5

(continued)

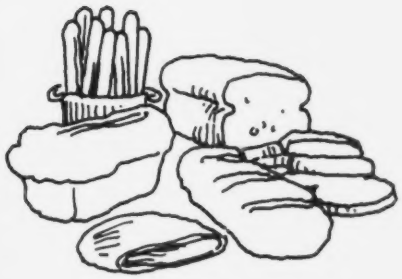
Food Composition Table

Food	Amount g	Calories	Water %	Carbo-hydrate g	Fat g	Protein g	Calcium mg	Iron mg	Vitamin A IU	Thiamin mg	Riboflavin mg	Niacin mg	Vitamin C mg
Fast Foods													
Dairy Queen													
Cone	1 med. (142 g)	230	NA	35	7	6.0	200	—	300	.09	.26	—	—
Kentucky Fried Chicken													
Chicken dinner original recipe	1 (346 g)	643	NA	46	35	35.0	NA	NA	25.5	.25	.32	8.5	36.6
McDonald's													
Egg McMuffin	1 (138 g)	352	NA	31	15	18	187	3.2	361	.36	.60	4.3	1.6
Hamburger	1 (102 g)	255	NA	30	10	12.0	51	2.3	82	.25	.18	4.0	1.7
Big Mac	1 (204 g)	541	NA	41	33	26	175	4.3	327	.35	.37	8.2	2.4
Filet-O-Fish	1 (139 g)	402	NA	37	25	15	105	1.8	152	.28	.28	3.9	4.2
Regular fries	1 (68 g)	220	NA	26	12	3.0	9	.6	17	.12	.02	2.3	12.5
Apple pie	1 (85 g)	300	NA	29	14	2.0	12	.6	69	.02	.03	1.3	2.7
Chocolate shake	1 (291 g)	364	NA	66	9	11.0	338	1.0	318	12	.89	.8	2.9
McDonaldland cookies	1 box (67 g)	294	NA	49	11	4.0	10	.03	48	.28	.23	.8	1.4
Wendy's													
Single hamburger	1 (200 g)	470	NA	34	26	26.0	84	5.3	94	.24	.36	5.8	.6
Double hamburger, with cheese	1 (325 g)	800	NA	41	48	50.0	177	10.2	439	.49	.75	11.4	2.3
French fries	1 regular serving (120 g)	330	NA	41	16	5.0	16	1.2	40	.14	.07	3.0	6.4
Frosty	1 (250 g)	390	NA	54	16	9.0	270	.9	355	.2	.6	—	.7





Recommended Dietary Allowances (RDAs)



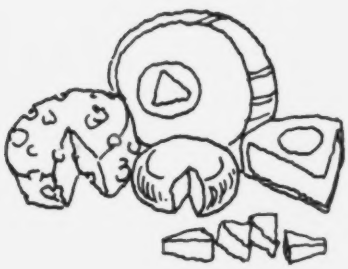


Chart I

Age (years)	Weight (kg)	Height (cm)
Children		
1–3	13	90
4–6	20	112
7–10	28	132
Males		
11–14	45	157
15–18	66	176
19–22	70	177
23–50	70	178
51–75	70	178
76+	70	178
Females		
11–14	46	157
15–18	55	163
19–22	55	163
23–50	55	163
51–75	55	163
76+	55	163

Chart II

	Children Ages 1-3	Children Ages 4-6	Children Ages 7-10
Energy (kcal)	1,300	1,700	2,400
Protein (g)	23	30	34
Vitamin A (IU)	2,000	2,500	3,300
Vitamin C (mg)	45	45	45
Thiamin (mg)	0.7	0.9	1.2
Riboflavin (mg)	0.8	1.0	1.4
Niacin (mg)	9	11	16
Calcium (mg)	800	800	800
Iron (mg)	15	15	10

Appendix 5

Recommended Dietary Allowances (RDAs)

Chart III

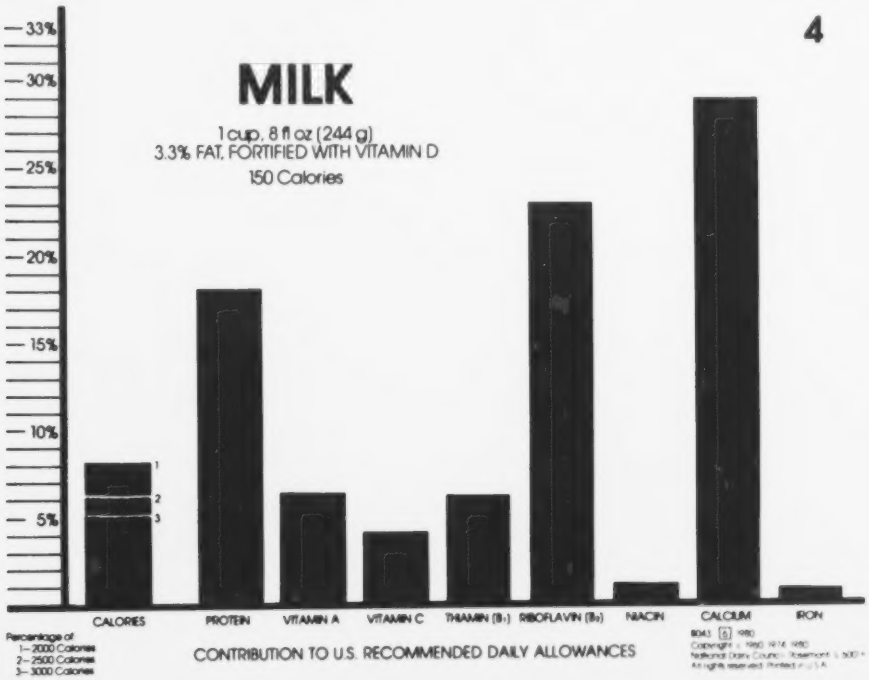
	Males (by age)					
	11-14	15-18	19-22	23-50	51-75	76+
Energy (kcal)	2,700	2,800	2,900	2,700	2,400	2,050
Protein (g)	45	56	56	56	56	56
Vitamin A (IU)	5,000	5,000	5,000	5,000	5,000	5,000
Vitamin C (mg)	50	60	60	60	60	60
Thiamin (mg)	1.4	1.4	1.5	1.4	1.2	1.2
Riboflavin (mg)	1.6	1.7	1.7	1.6	1.4	1.4
Niacin (mg)	18	18	19	18	16	16
Calcium (mg)	1,200	1,200	800	800	800	800
Iron (mg)	18	18	10	10	10	10

Chart IV

	Females (by age)					
	11-14	15-18	19-22	23-50	51-75	76+
Energy (kcal)	2,200	2,100	2,100	2,000	1,800	1,600
Protein (g)	46	46	44	44	44	44
Vitamin A (IU)	4,000	4,000	4,000	4,000	4,000	4,000
Vitamin C (mg)	50	60	60	60	60	60
Thiamin (mg)	1.1	1.1	1.1	1.0	1.0	1.0
Riboflavin (mg)	1.3	1.3	1.3	1.2	1.2	1.2
Niacin (mg)	15	14	14	13	13	13
Calcium (mg)	1,200	1,200	800	800	800	800
Iron (mg)	18	18	18	18	10	10

National Dairy Council
Food Comparison Cards

The following are two examples of the food comparison cards developed by the National Dairy Council. Each 8 1/2" x 11" card shows the Calorie and nutrient profile of one food. The complete set of 60 cards is available from National Dairy Council Offices (Appendix 2).



Courtesy National Dairy Council

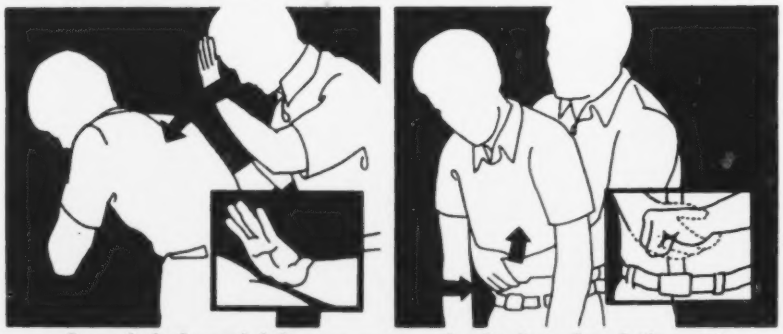
First Aid for Choking

FIRST AID FOR CHOKING

1 IMPORTANT: if victim can speak, breathe, cough, stand by but DO NOT INTERFERE

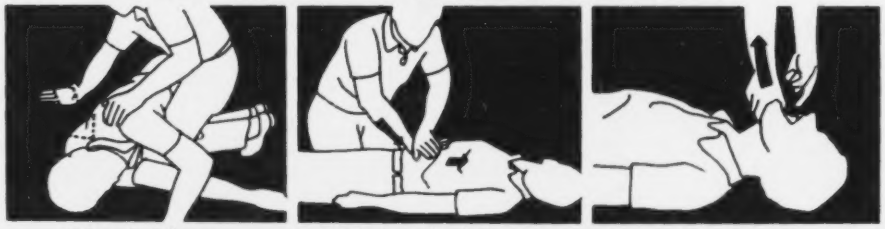
2 CALL AMBULANCE if victim cannot breathe, speak, cough.
Telephone _____

3 IF VICTIM IS CONSCIOUS:



4 quick hard blows THEN 4 abdominal thrusts
Repeat until food is forced out.

IF VICTIM IS UNCONSCIOUS:



4 back blows THEN 4 abdominal thrusts THEN clear mouth
Repeat steps until food is forced out.
Do mouth-to-mouth or CPR as necessary.

New York State Health Department

You Are the Scientist

Many scientists throughout the world are constantly conducting experiments of all kinds. Sometimes their experiments reveal answers to important research questions. Sometimes they only raise more questions.

In ***The Nutrient Connection***, *you* are the scientist searching for answers. The experiments you will do are similar to ones food scientists and nutritionists might do. Some of these experiments may raise other questions you will want to answer. If that happens, you can design additional experiments just as real scientists do.

Before you begin, you must know two important standards of good research.

Scientists Keep Accurate Records

Scientists are constantly checking to make sure their experiments are providing the right answers. They may repeat the same experiment many times. They also ask other scientists to do the experiment to see if they get the same results. To be sure they have all the facts they need, scientists must keep accurate records of their work.

You will need to keep a notebook to record the results of your experiments, too. You may buy a notebook for this purpose or make one by stapling pieces of paper together.

Every time you do any experiment, enter in the notebook the title of the experiment and the date you did it. Then write down what you did and what results you saw. You might want to draw pictures as well. These observations will help you understand what happened in the experiment. They will also be important if you decide to do the experiment again.

Never erase anything in your notebook. If you make a mistake, draw a line through the mistake and write the correction next to it. Put your initials beside the correction so that people who read the records will know you made the change.

Never tear a page from your notebook. That page may contain valuable information that you or someone else will need to refer to later.

Scientists Are Safety Conscious

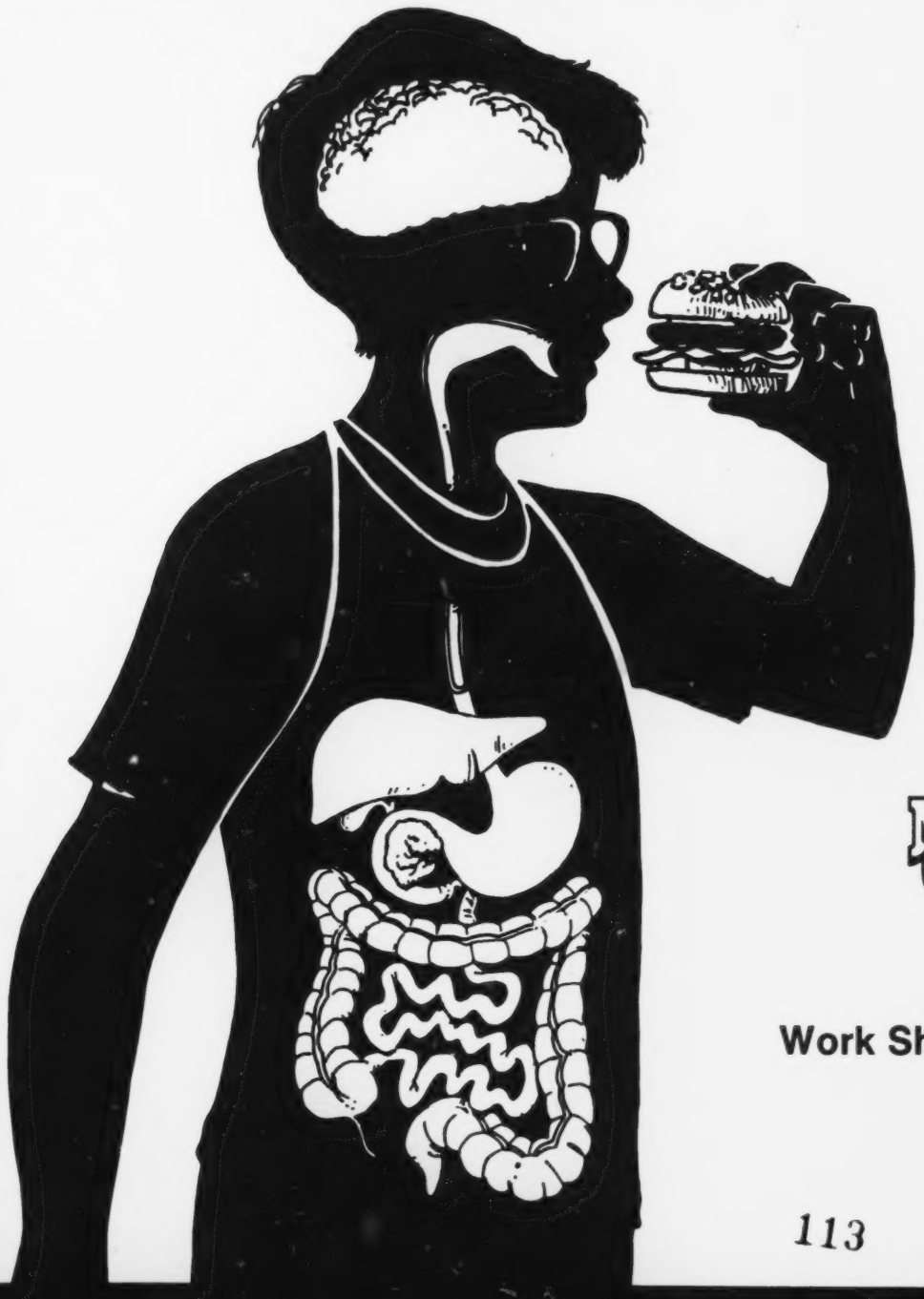
Scientists take many precautions to be sure their laboratories and research methods are safe. You will need to follow the same safety rules in your laboratory.

Treat all laboratory equipment with extreme care. Much of it is expensive and fragile. Broken glassware, open fire, and hot appliances can cause serious injury.

Always be cautious when working with chemicals. Some may be poisonous, and many can be dangerous if they are not handled properly.

Keep yourself and your work station clean. Wipe up any spills immediately. Wash your hands before and after conducting an experiment.

The Nutrient Connection



NUTRITION COMES ALIVE

Level 5

Work Sheets, Information Sheets, Puzzles, Letter to Parents

New York State Revised Edition

SP 028 335

Nutrition Comes Alive

Level 5
The Nutrient Connection

Work Sheets, Information Sheets, Letter to Parents, Puzzles

A Revision by Leilani B. Peck

Based on materials developed by Martha Plass

Division of Nutritional Sciences, a division of the New York State College of Human Ecology and the New York State College of Agriculture and Life Sciences, Cornell University, Ithaca, New York 14853. 1986.

Work Sheets, Information Sheets, Letter to Parents, Puzzles

Work Sheets, Information Sheets, Letter to Parents, Puzzles	Letter Code
For Section 1	
Trillions of Tiny Cells	A
Looking at Cells with a Microscope	B
Compare These Cells	C
Making a Cell Model	D
The Balancing Act	E
What's Your Temperature?	F
Growing Yeast	G
You Could Be a Giant!	H
For Section 2	
A Brief Review of the Nutrients	I
Key Nutrients	J
Food: The Undercover Story	K
Water Moves the Goods	L
Finding Food's Hidden Water	M
Apple Head Dolls	N
Making a Calorimeter to Count Calories	O
Fat in Foods	P
Letter to Parents	Q
Sugar—A Congressional Hearing	R
Protein Match Game	S
Protein in Foods	T
Where's the Protein?	U
Vitamin C	V
Vitamin C as an Antioxidant	W
What's in It?	X

It All Adds Up	**Y**
Food Groups	**Z**
What Did You Eat Today?	**AA**
Situations	**BB**

For Section 3

The Amazing Food Tube Crossword Puzzle and Word Search	**CC**
The Amazing Food Tube	**DD**
Chew, Chew, Chew	**EE**
The Man with a Hole in His Stomach	**FF**
Protein Digestion	**GG**
Girl with Stomachache	**HH**
Say Cheese	**II**

Name_____

Trillions of Tiny Cells

Cells are so small and so compact that thousands of them could fit inside this o. Scientists have estimated that there may be as many as 100 trillion cells in your body. Do you have any idea how many that is?

1. Write the number **one thousand** _____

   Write **one million** _____

   Write **one billion** _____

   Now, write **one trillion** _____

   How many zeroes does it have? _____

   How many more zeroes would be needed to make 100 trillion? _____

   One hundred trillion looks like _____

2. Now relate those numbers to something familiar, like large numbers of people.

   How many people live in New York State?

   _____

   How many people live in the United States?

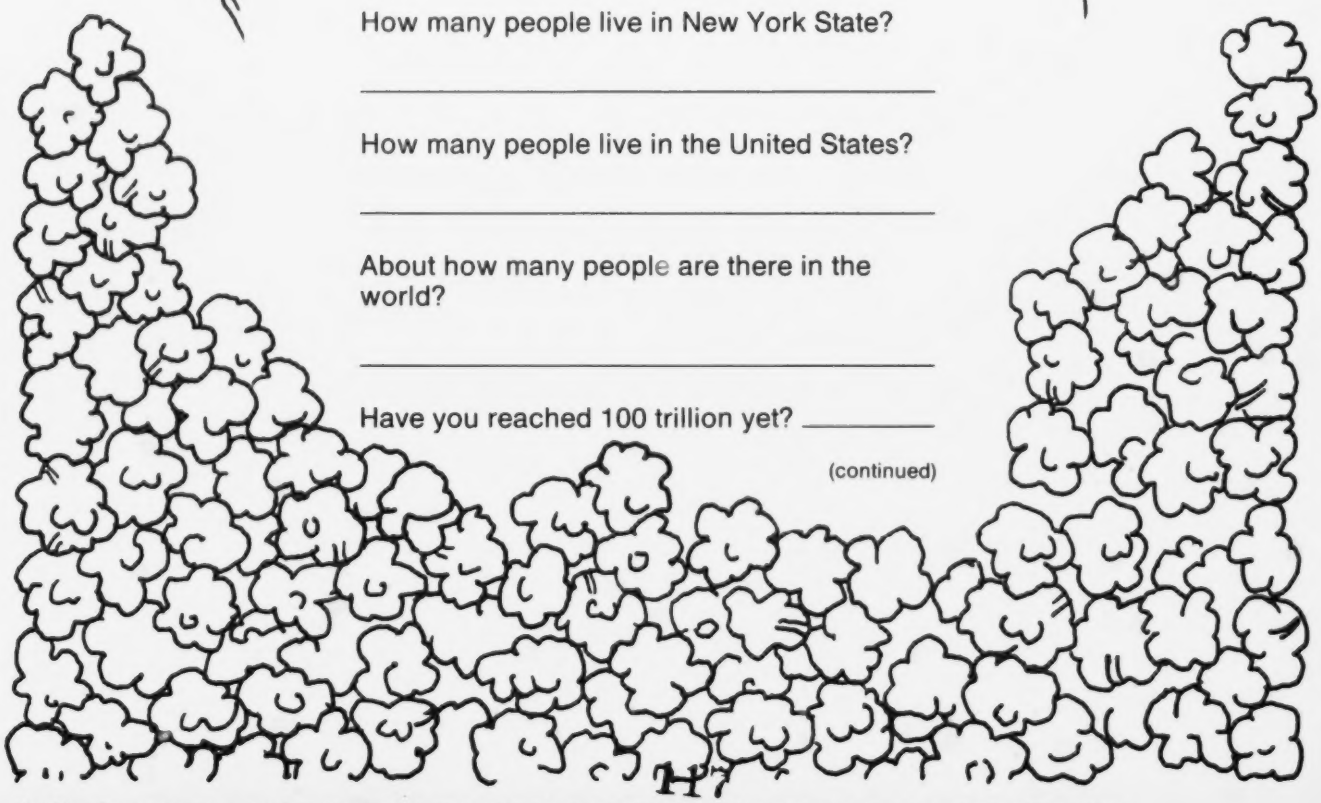
   _____

   About how many people are there in the world?

   _____

   Have you reached 100 trillion yet? _____

(continued)



3. Suppose you have an unlimited supply of hot dogs. Each one is 6 inches long. How far would a string of 100 trillion hot dogs reach? Around the world? To the moon? To the sun? Start by finding the answers to the following questions.

   How many feet are there in a mile? _____ feet

   What is the distance around the equator?

   _____ miles

   What is the distance from the earth to the moon?

   _____ miles

   What is the distance from the earth to the sun?

   _____miles

   How many hot dogs laid end to end would reach

   one mile? _____ hot dogs

   How many miles would 100 trillion hot dogs

   reach? _____ miles

   Would they circle the earth at the equator?

   _____

   Would they reach to the moon and back?

   _____

   Would they reach the sun? _____

4. To help you imagine how tiny your cells are, first pretend they are the size of popcorn. Then try to picture how big you would be. This problem will give you an idea of how much space 100 trillion pieces of popcorn would occupy.

   Fill a 6-inch cube-sized box with popcorn. How many pieces will fit?

   _____

   Now multiply that number by 8 to find out how many pieces would fill a cubic foot.

   _____

   Next use a rigid measuring stick to measure the dimensions of your classroom. Round off the measurements to the nearest foot.

   length of the room _____ feet

   width of the room _____ feet

   height of the room _____ feet

   Multiply these three measurements (length x width x height) to find the cubic feet in the room.

   _____ cubic feet

   How many pieces of popcorn would you need to fill your classroom?

   _____

   Have you reached 100 trillion yet? _____
   If not, figure out how many classrooms would be needed to hold all your popcorn-sized cells.

   _____

   After all that figuring, what size do you think your cells really are?

   _____

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Science, Cornell University, 1986.

Looking at Cells with a Microscope

It is one thing to look at pictures of cells and quite another to see real cells with your own eyes. You can't see cells with the naked eye, of course. They are too small. But you can see them with the help of a microscope. In this experiment, you will be able to compare onion cells with cells from your own body.

Materials

Pencil and paper
Compound microscope
Onion
Knife
Water
Glass slides
Toothpicks
Cover slips
Eyedropper
Iodine (Be careful. Iodine is a poison.)
Paper towel
Methylene blue (You may substitute iodine, if necessary.)

Procedure

1. Watch carefully while your teacher demonstrates how to operate the compound microscope. Treat it gently.

2. Peel an onion and cut it into quarters. Remove a section from one of the quarters (Figure 1). On the outside, you will find a transparent "skin" as thin as tissue paper. Pull off a small piece of this skin and place it in a drop of water on a glass microscope slide (Figure 2). Gently flatten the tissue with a toothpick. Cover it with a cover slip (Figure 3).

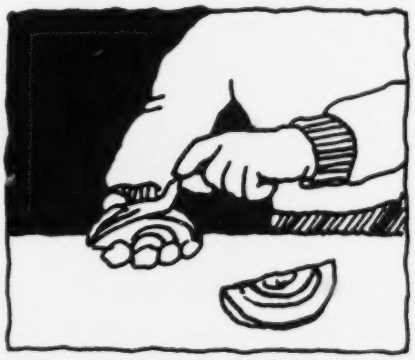


Figure 1

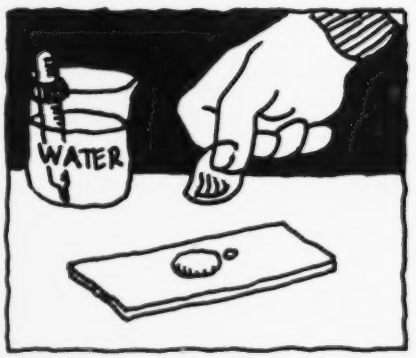


Figure 2

3. You may have to stain the cells to make the parts easier to see. Using the eyedropper, add a drop of iodine at one edge of the cover slip (Figure 4). Be careful—iodine is a poison. Pull the stain across the cells by touching the tip of a paper towel to the edge of the cover slip *opposite* where you put the iodine (Figure 5). The towel absorbs the water under the cover slip and draws the iodine stain over the tissue.

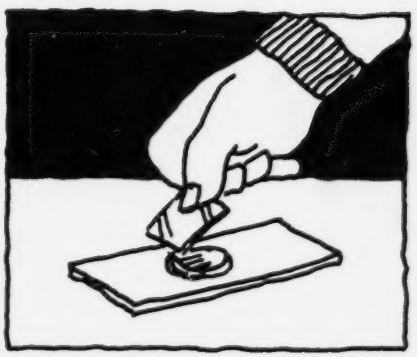


Figure 3

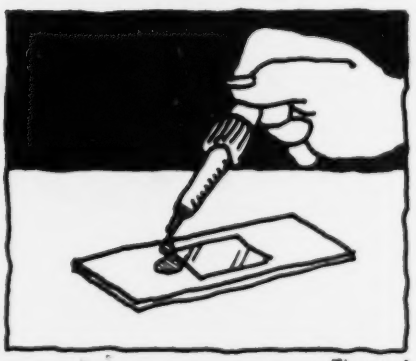


Figure 4

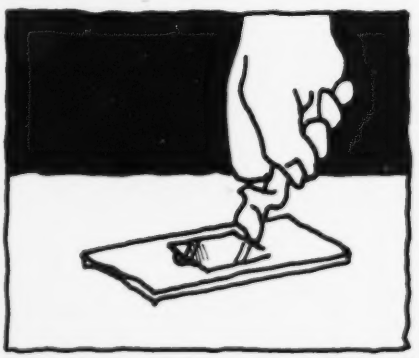


Figure 5

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Science, Cornell University, 1986.

4. Place the slide under the microscope and look at the onion cells through the low-power lens. The cells will look like a brick wall. Each brick is one cell.

5. Now look through the high-power lens. You will see a dark spot inside each cell. It is the nucleus. You will also see two thin lines around each cell. The inner line is the cell membrane. The outer line is the cell wall. (With some microscopes, it may be difficult to tell the two apart.)

6. Gently scrape the inside of your cheek with a clean toothpick. With a knife, carefully scrape some of the white matter from the toothpick into a drop of water on a glass slide. Spread the material in the water and lay a cover slip over the drop. Stain the cells with methylene blue (or iodine) as you did in step 3.

7. Examine the tissue from your cheek under the low-power lens, then under the high-power lens of the microscope.

Observations

1. Draw pictures of the onion and the human cells you looked at. Label the **nucleus** and **cell membrane** in each cell.

2. What does the onion cell have that the cheek cell doesn't? Why is it there?

3. Look through someone else's microscope. Are that person's cheek cells the same as yours?

4. Why do you think onion cells and cheek cells are shaped the way they are?

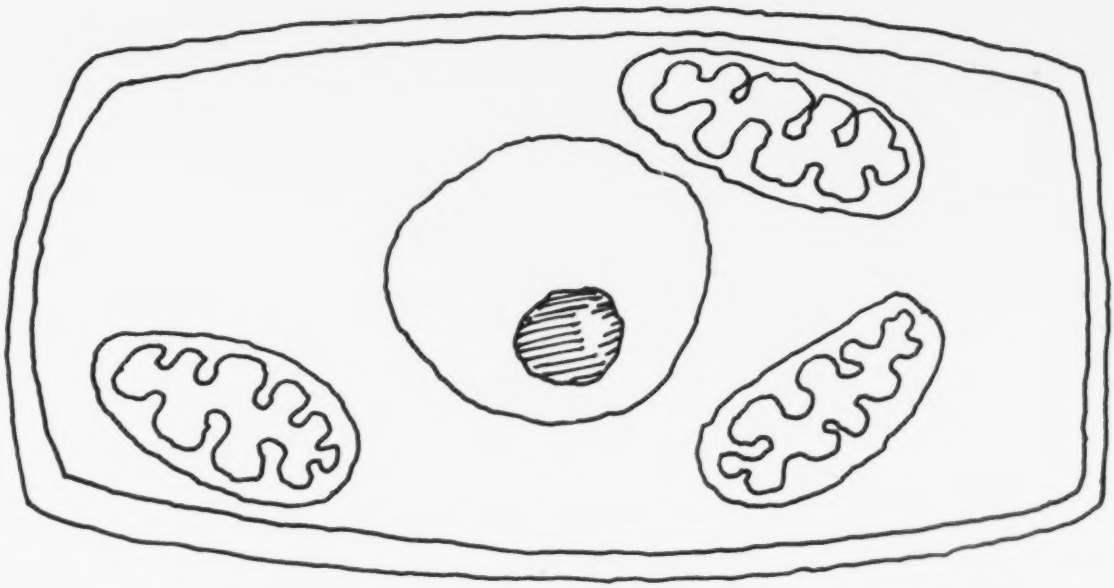
To Learn More

Once you have looked at onion and cheek cells, you may want to make slides of other cells. Here are some suggestions:

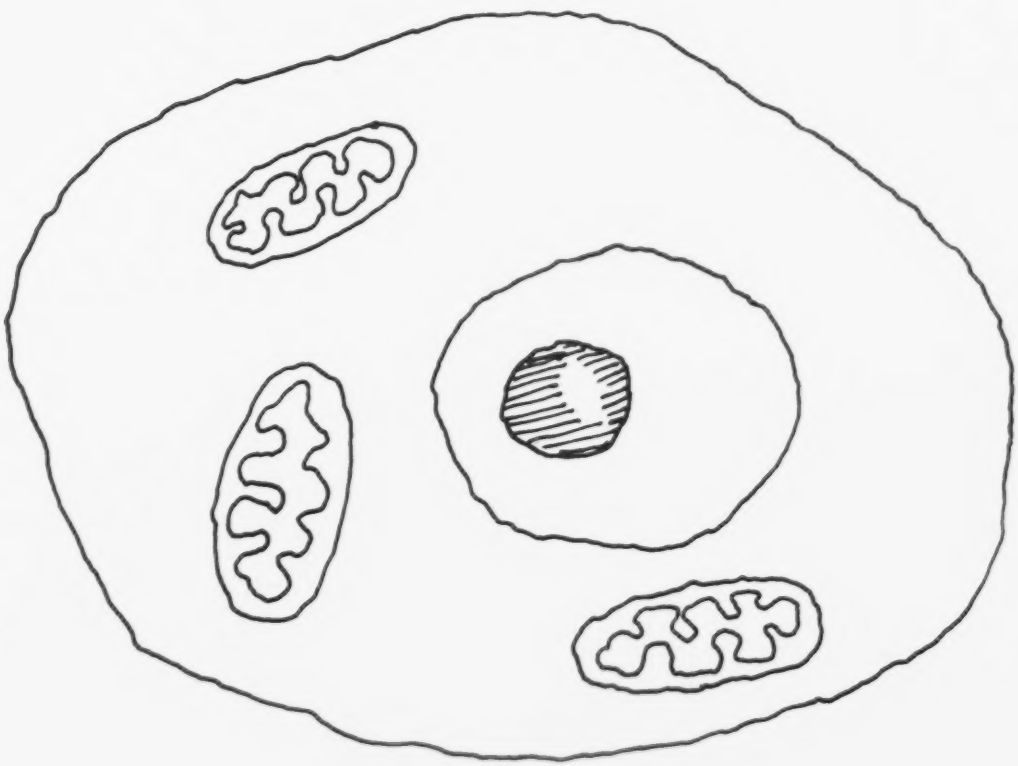
- Hair
- Skin
- Blood
- Animal fur
- Paper-thin slice of celery
- Tomato skin
- Membrane of an orange section
- Pond water

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Science, Cornell University, 1986.

Compare These Cells

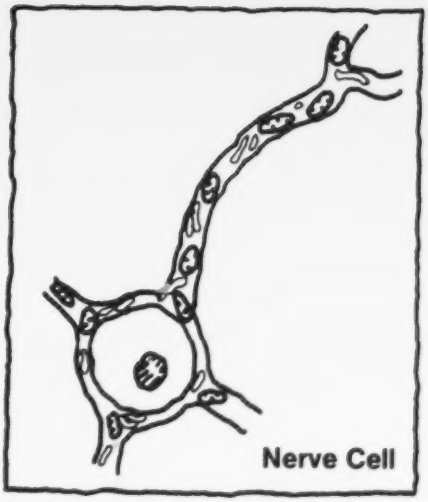


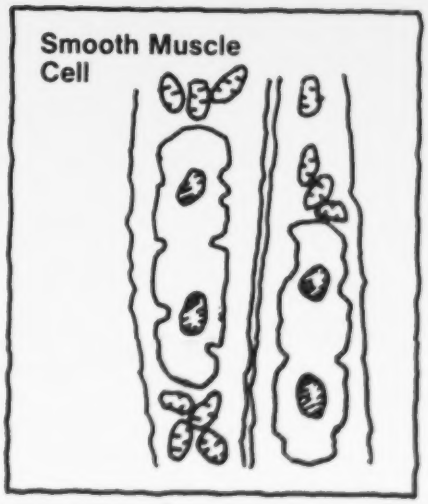
Composite Plant Cell

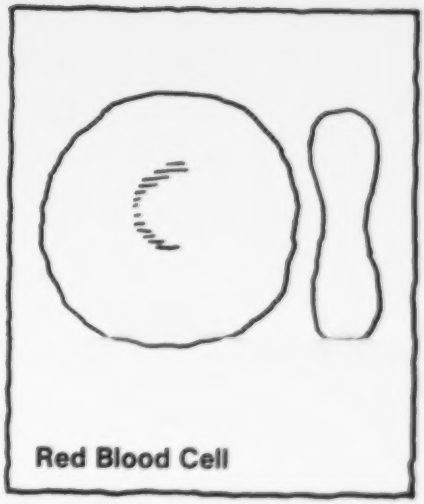


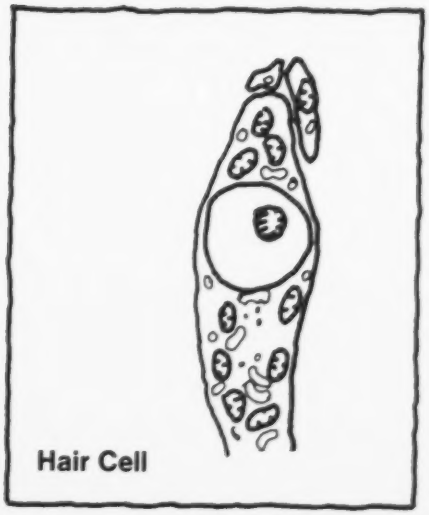
Composite Animal Cell

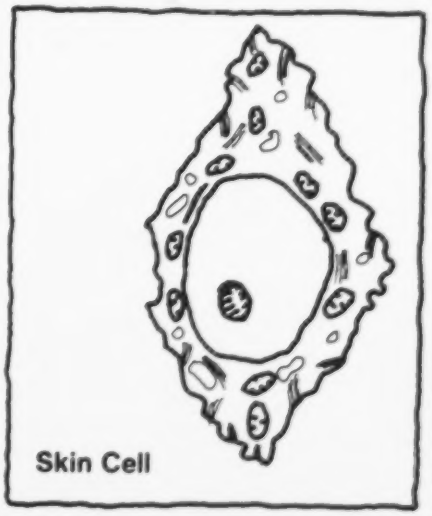
Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Science, Cornell University, 1986.

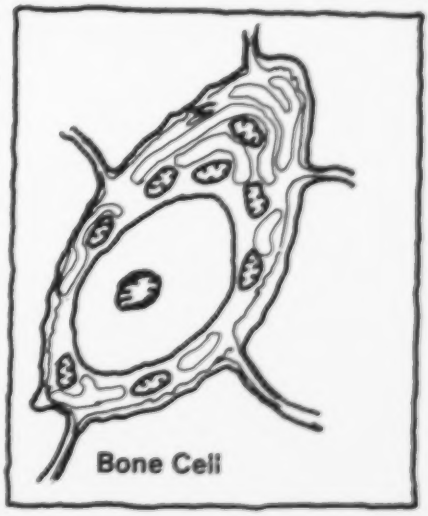


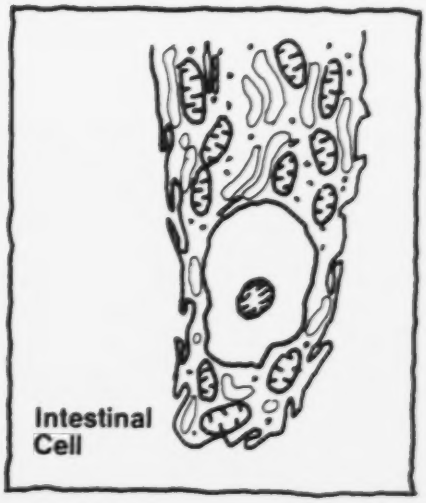


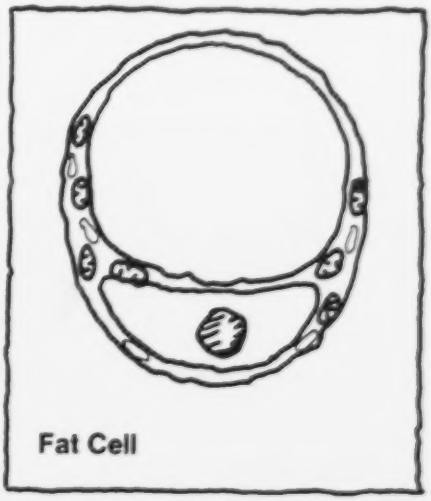












Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Science, Cornell University, 1986.

Making a Cell Model

The cells in your body are so tiny you cannot see them without a microscope. But you can make a model of a cell with materials you can easily find at school or at home. Then you can get a better idea of how a cell looks and how its membrane works. In this experiment, you will make two model cells, using a plastic bag for a **membrane**, clay for the **nucleus**, and gelatin for **cytoplasm**.

Materials

Pencil and paper
Water
2 plastic sandwich bags
Measuring cup and spoons
Cornstarch
1 envelope unflavored gelatin
Mixing bowl
Mixing spoon
Saucepan
Hot plate
Modeling clay
2 one-foot lengths of string
Scissors
2 glass jars (at least half-pint size) with screw lids
Iodine (Be careful. Iodine is a poison.)
Eyedropper

Procedure

1. Pour water into each plastic sandwich bag to see if any water can seep through the plastic. Pour the water back out.

2. Mix 1 teaspoon of cornstarch with 1 envelope of gelatin in a mixing bowl (Figure 1). Stir in 1/2 cup cold water and set the mixture aside for a few minutes.

3. Measure 1 cup water into the saucepan. Bring it to a boil on the hot plate. Slowly add the boiling water to the gelatin mixture and stir to dissolve the ingredients. Cool to lukewarm.

Figure 1

4. Pour some of the mixture into each plastic bag (Figure 2). Add a clay "nucleus" about the size of a marble to each bag (Figure 3). Using the one-foot lengths of string, tie each bag tightly, squeezing out any trapped air. Cut away the excess bag above the knot, but do not cut away the string.

Figure 2

Figure 3

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Science, Cornell University, 1986.

5. Fill two glass jars three-quarters full of warm water. To one jar, add enough iodine with the eyedropper to turn the water a light brown color (Figure 4). Lower a gelatin "cell" into each jar, making sure the tied end remains out of the water (Figure 5). Hang the string ends over the lip of the jar and screw on the lid to hold the "cell" suspended in the water. Let the cells stand overnight.

Figure 4

Figure 5

Observations

1. Was the water able to pass through the plastic sandwich bag in the first step? What does this tell you about the size of the water molecules and the size of the holes in the plastic? Which do you think are bigger?

2. What difference did you see in the two cells after they had been in the water overnight? Record your observations. (Iodine turns blue when it comes it contact with cornstarch.)

3. Why was there a change in one jar and not the other?

4. Why did the change occur on one side of the "membrane" and not the other?

5. What can you conclude about the way the cell membrane controls which molecules pass in and out of the cell?

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Science, Cornell University, 1986.

The Balancing Act

Membranes have to perform a delicate balancing act to keep the concentration of molecules at the right level for the cells. When conditions are not ideal, concentrations can get out of balance. This experiment shows what can happen to vegetable cells when they are placed in concentrated solutions of salt and sugar.

Materials

Pencil and paper

Fresh crisp celery, potato, and carrot

Knife

5 bowls (at least 1 pint capacity)

Measuring cup

Water

Tablespoon

Table salt

Stirring spoon

Granulated sugar

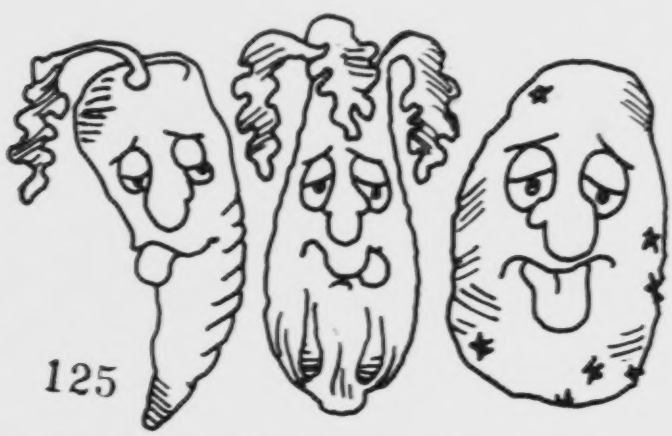
Ice

Procedure

1. Carefully cut the celery, potato, and carrot into strips.
2. Set out 3 bowls. Label them A, B, and C.
3. Add 1 cup of plain water to each bowl. Set aside bowl A.
4. Add 2 tablespoons salt to the water in bowl B. Stir to dissolve.
5. Add 2 tablespoons sugar to the water in bowl C. Stir.
6. Place a strip of celery in each bowl. Do the same with strips of carrot and potato. Leave one strip of each vegetable sitting out in an empty bowl. Wait 30 minutes.
7. After a half hour has passed, move the strips of vegetables that were in the empty bowl to a bowl of ice water. Wait 10 more minutes.

Observations

1. What did the vegetables look like before you put them in the bowls?
2. What did the vegetables in each bowl look like after 30 minutes? Was there any difference in the vegetables in bowls A, B, and C?
3. What happened to the strips you put in ice water?
4. What do you think was happening to the cells of these vegetables? Why?



Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Science, Cornell University, 1986.

What's Your Temperature?

The cells in your body are constantly burning fuel to make energy for the jobs they do. Another way they use this energy is to control your internal "climate" or body temperature. Try this experiment to see what happens to water temperature, air temperature, and your own temperature over a period of 30 minutes.

Materials

Pencil and paper

Laboratory thermometer (or a waterproof thermometer with a range between freezing and boiling)

A pan of hot water

Oral thermometer

Indoor/outdoor thermometer

Alcohol

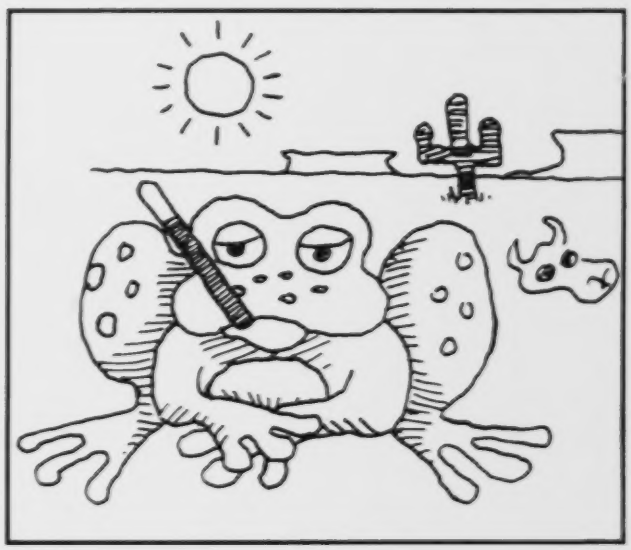
Cool, soapy water

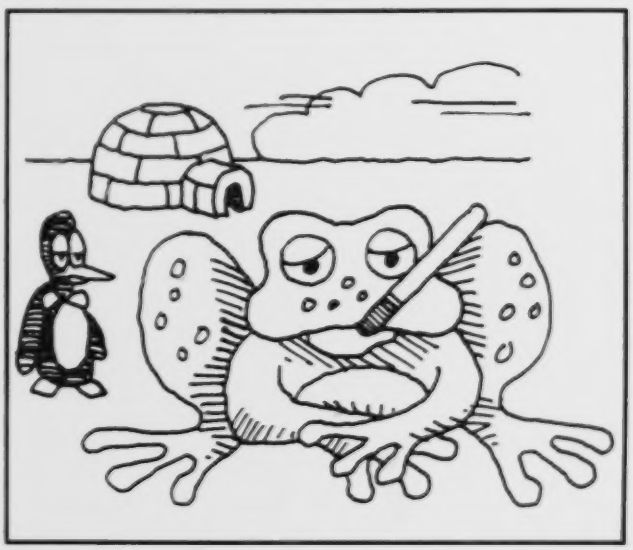
Procedure

1. Use the laboratory thermometer to measure the temperature of the hot water. Write down the temperature.
2. Use the oral thermometer to measure your body temperature. Write down the temperature.
3. Use the indoor/outdoor thermometer to measure the room temperature. Write down the temperature.
4. Wait 30 minutes, then measure and record all three temperatures again.
5. Be sure to dip the oral thermometer in alcohol and wash it in cool, soapy water before passing it on to a classmate to use.

Observations

1. Did the water temperature change in 30 minutes? Why?
2. Did your body temperature change? Why?
3. Did the room temperature change? Why?





Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Science, Cornell University, 1986.

To Learn More

Check your temperature at different times during the day when you are in different places and doing different things. Does it change? How does it compare with the outside temperature?

Find out the difference between cold-blooded and warm-blooded animals. What happens to the body temperature of a frog when the temperature in its environment changes?

Figure 1

Figure 2

To take your own temperature, carefully shake the thermometer until the mercury (silver line) goes below 97 degrees F (Figure 1). Place the bulb end of the thermometer under your tongue and hold it there for 3 minutes (Figure 2). Roll the thermometer back and forth between your thumb and forefinger until you can see the silver line on the scale (Figure 3). Each marking between numbers represents two-tenths of a degree. After you have read your temperature, dip the thermometer in alcohol to sterilize it, then wash it in cool, soapy water (Figure 4).

Figure 3

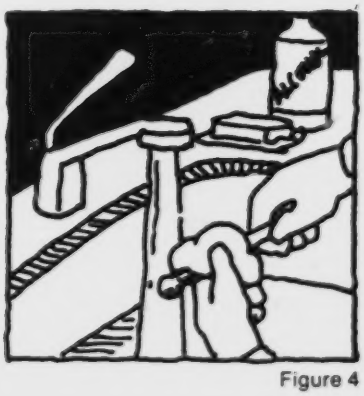


Figure 4

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Science, Cornell University, 1986.

Growing Yeast

There is a reason your internal climate stays fairly constant. All the chemical reactions that go on inside your body are very sensitive to temperature. If your body temperature changes too much, those reactions suffer, and so do you. In this experiment, you will test the effect of temperature on the chemical reactions in a living one-celled organism.

Materials

Pencil and paper
4 small glasses
Measuring spoons
Active dry yeast
Granulated sugar
Stirring spoon
Water
Small saucepan
Hot plate
Bowl
Ice

Procedure

1. Label the 4 glasses A, B, C, and D.
2. Put 1 teaspoon of active dry yeast into each glass. Add 1 teaspoon of sugar to the glasses marked B, C, and D. Stir 2 tablespoons of lukewarm water (110–115 degrees F) into each of the four glasses.
3. Let glass A and glass B sit at room temperature while you go on to step 4.
4. Pour the contents of glass C into the saucepan. Heat to boiling on the hot plate. Cool to lukewarm. Pour the mixture back into glass C.
5. Place glass D in a bowl of ice for 30 minutes. Remove the glass from the ice and leave it at room temperature for 30 more minutes.

Observations

1. What happened to the yeast mixtures in each of the four glasses?
2. What happened after glass D sat at room temperature for 30 minutes?
3. At which temperature did the yeast grow most quickly?
4. Why was table sugar added to the yeast-water solution? Remember that there was no sugar in glass A.

To Learn More

Look up several bread recipes calling for yeast. What purpose does the yeast serve in the recipes? Do the recipes also call for sugar or honey? Why?

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Science, Cornell University, 1986.

Name_____

You Could Be a Giant!

Did you ever think about how fast you grew in the nine months before you were born? In that short time, you grew from an almost weightless single cell to billions of cells weighing a total of six, eight, or even ten pounds.

Growth keeps up at a fast pace after birth, too. On the average, babies can be expected to triple their birth weight in the first year.

1. If a baby girl weighed eight pounds at birth, how much would you expect her to weigh on her first birthday?

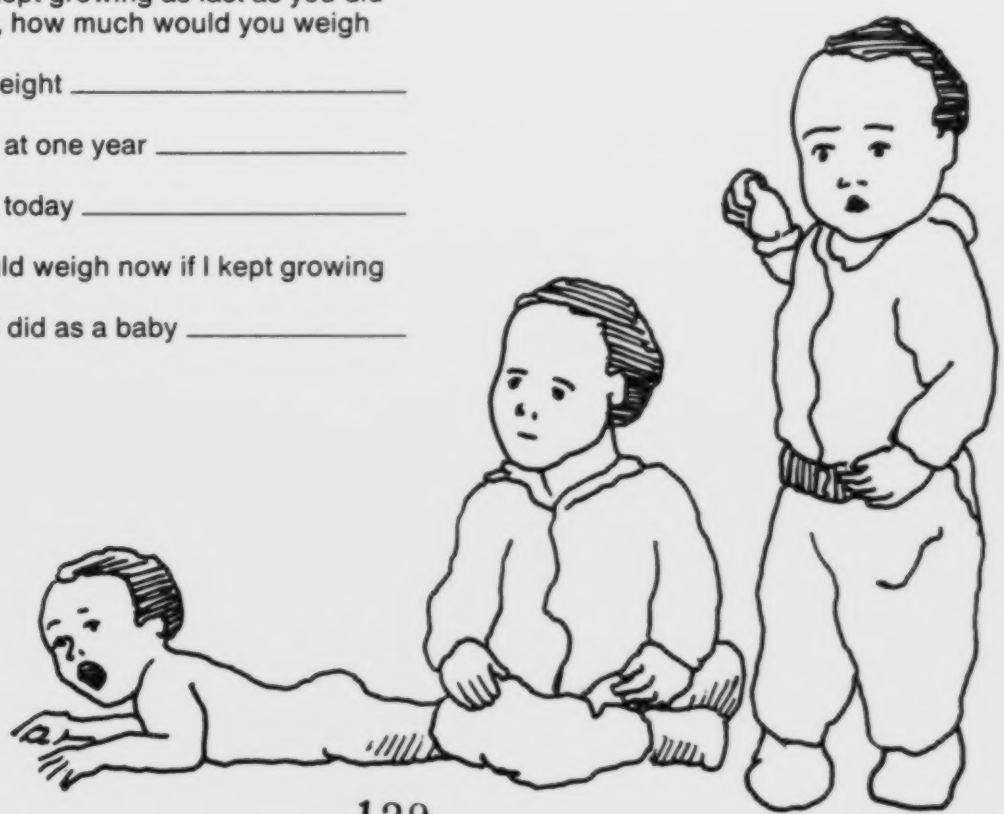
   _____

2. If she continued to grow at that rate (tripling her weight each year), how much would she weigh by her fifth birthday?

   _____

3. How much did you weigh at birth? At one year? If you kept growing as fast as you did that first year, how much would you weigh by now?
   a. My birth weight _____
   b. My weight at one year _____
   c. My weight today _____
   d. What I could weigh now if I kept growing as fast as I did as a baby _____

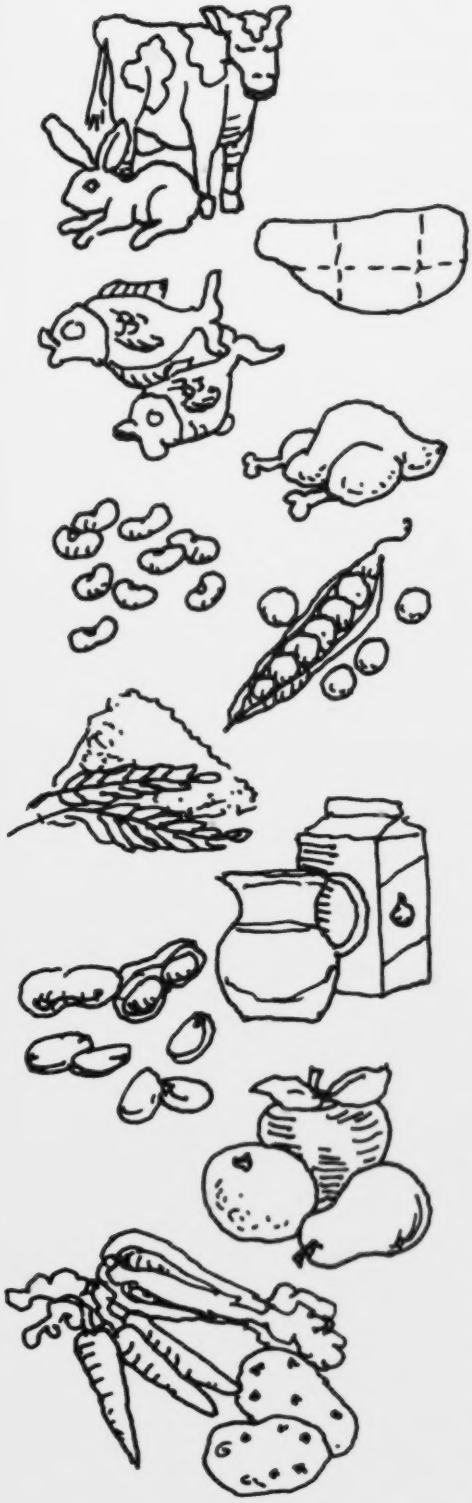
4. What can you think of that would weigh as much as your answer in step 3d? Try to imagine yourself that size. On the page showing a picture of a tall building, draw yourself in proportion to the other objects.



Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Science, Cornell University, 1986.

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Science, Cornell University, 1986.

A Brief Review of the Nutrients



Water

Water may not seem like a nutrient, but it is, and probably our most important one. Humans can live several weeks without food but only a few days without water. Water makes up almost *two-thirds* of the body. It is part of *every cell.* Water carries all the other nutrients to the cells and takes wastes away. It also helps regulate body temperature. Every food has some water in it.

Proteins

Proteins are the building blocks of the body. That means every tissue is made of some form of protein. Even enzymes, antibodies, and hormones are proteins. Without a steady supply of new protein, we couldn't grow new cells. Our wounds would not heal. Worn-out cells could not be replaced. Protein can also be used for energy if the body doesn't get enough Calories from carbohydrates and fats. Excess protein is changed to fat and stored. Meat, fish, poultry, dairy products, and eggs are good sources of protein. Grains, nuts, seeds, and legumes (dry peas and beans) also contain some protein.

Carbohydrates

The main function of carbohydrates is to supply energy. That's a tall order because all 100 trillion cells in the body need a constant supply of fuel. Otherwise, their "factories" (if you think of them that way) would grind to a halt. Even when you don't think you are doing a thing, your heart is beating and your lungs are working. In fact, every organ is busy doing something.

There are three different kinds of carbohydrates. The simplest carbohydrates are **sugars** such as glucose, fructose, dextrose, and sucrose. Sugars are found naturally in fruits, milk, and some vegetables such as peas. Refined sugars from sugar beets and sugarcane are used for table sugar and as sweeteners in processed foods and home recipes.

Starches are more complex carbohydrates. They are found in rice, potatoes, vegetables, breads, and cereals. Complex carbohydrates are receiving new attention because they are so essential to health. Up until now, most people thought foods rich in complex carbohydrates were "only starch" and should be avoided. Now we understand that these foods are important in our diets, partly because they provide other important nutrients.

Fiber is the complex carbohydrate that forms the tough cell walls in plants. Even though humans can't digest fiber, it is important because it helps keep food moving through the digestive tract. Fiber may also help keep the intestines in good working order. All plants supply some fiber, but whole grains, fruits, and vegetables are especially good sources.

About a pound of carbohydrate is stored in the liver in a form called **glycogen**. This glycogen is used when the body needs quick energy. Any other excess carbohydrate is converted to fat and stored as fatty tissue.

Fats

Fats are the nutrients that supply the most energy—more than twice as much as carbohydrates. They also carry four important vitamins (A, D, E, and K) through the body and supply some fatty acids that are absolutely necessary for good health. The fat that is stored in the body helps insulate, cushion, and protect us. Foods such as butter, margarine, oils, shortenings, and salad dressings are easy to pick out as fats. But not all sources of fat are so obvious. Whole milk, cheeses, ice cream, meat, poultry, fish, nuts, seeds, avocados, olives, gravies, sauces, bakery foods, fried foods, and even some candies contain fats.

Vitamins

Scientists knew there was something else in food besides water, carbohydrates, protein, and fat long before they could isolate the mystery ingredient in the laboratory. The mystery remained unsolved until 1913, when the unknown ingredient was finally discovered. As it turned out, it wasn't just one ingredient but several similar chemicals that we now call "vitamins." Although each has a scientific name, we know them best by their letter names A, B, C, D, E, and K. (There are eight different B vitamins and some vitamins such as niacin that don't have letter names.)

Vitamins probably eluded scientists for so long because foods contain such tiny amounts of them. Nevertheless, without even these tiny amounts, the cells couldn't do their jobs. Vitamins are responsible for helping to form the material that holds cells together, for helping bones and teeth use calcium, for helping the body use energy, and for many other critical life-support activities.

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Minerals

Like vitamins, the minerals in foods were hard to isolate because there were so many of them doing so many specialized jobs. Minerals do such diverse tasks as building strong bones or maintaining the right amount of water inside the cells. The major minerals we need are calcium, phosphorus, magnesium, sulfur, sodium, potassium, and chloride. But we also need certain other minerals in very tiny amounts. Some of these trace minerals are iron, iodine, fluoride, and zinc.

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Key Nutrients

Nutrient	What It Does	Major Food Sources
1. Protein	Necessary for growth and for building and maintaining skin, muscles, brain, hair, and all body tissues. Used to make antibodies, enzymes, and hormones. Supplies energy.	Meat, poultry, fish, dried peas and beans, eggs, cheese, milk, nuts
2. Carbohydrate	Supplies energy. Main source of energy for the brain. Unrefined carbohydrates supply fiber, which helps the digestive tract.	Cereal, flour, rice, pasta products, dried beans, fruits, vegetables, sugar
3. Fat	Supplies concentrated energy. Provides and carries fat-soluble vitamins (A, D, E, K) and fatty acids. Insulates and cushions the body.	Butter, margarine, oils, nuts, shortening, salad dressing
4. Vitamin A	Helps keep skin and membranes (e.g., in the nose and intestines) healthy. Helps prevent sickness. Helps eyes see in dim light.	Liver, carrots, sweet potatoes, spinach, winter squash, greens, apricots
5. Vitamin C (Ascorbic acid)	Helps form substance that holds our body cells together, speeds healing of wounds and increases resistance to infection. Helps the body use iron.	Oranges, grapefruit, broccoli, papaya, mango, strawberries, green peppers, cauliflower, tomatoes, cabbage, spinach
6. Thiamin (B_1)	Helps the body use carbohydrates. Important for healthy nerves and for good appetite.	Pork, nuts, fortified cereals, pasta products, dried beans
7. Riboflavin (B_2)	Helps the body use energy. Important for healthy skin and eyes.	Liver, milk, yogurt, cottage cheese

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Key Nutrients

Nutrient	What It Does	Major Food Sources
8. Niacin	Helps the body use carbohydrate and fat. Necessary to make body fat and help cells breathe. Important for healthy nerves, skin, and digestive tract. Helps digestion and appetite.	Liver, meat, poultry, fish, peanuts, fortified cereals, bread, flour
9. Calcium	Gives structure and strength to bones and teeth. Helps in blood clotting. Helps nerves and muscles work.	Milk, yogurt, cheese, sardines and salmon with bones, turnip greens, collard greens, kale
10. Iron	Forms an important part of hemoglobin, the compound in blood that carries oxygen and carbon dioxide between the lungs and body cells. Help prevent sickness.	Liver, red meat, dried peas and beans, prunes
11. Water	Solvent for other nutrients. Carries nutrients to cells and wastes away. Helps regulate body temperature. Constitutes nearly two-thirds of body weight.	All foods and beverages

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Name_____

Food: The Undercover Story

Test Station 1
Carbohydrates (Starch)

Materials and Equipment

Paper and pencil

Food samples to test (Caution: Do not eat any of the foods you have tested.)

Aluminum foil

Eyedropper

Iodine (Caution: Iodine is a poison.)

Procedure

1. Place the first food sample on a piece of aluminum foil. Using the eyedropper, place a few drops of iodine on the food. Foods that contain starch will turn dark blue where they come in contact with iodine. Observe and record any changes on the Experiment Data Sheet.

2. Repeat with each of the other samples, using clean aluminum foil.

Observations

1. Which foods do you think contain starch?

2. Starch is a complex form of carbohydrate. Sugar is a simpler form that does not turn dark blue when tested with iodine. Therefore, foods that do not test positive for starch could still contain sugar. Which foods do you think contain sugar? Why?

Test Station 2
Fat

Materials and Equipment

Paper and pencil

Small squares of brown paper bag or brown paper towel

Food samples to test (Caution: Do not eat any of the foods you have tested.)

Container of water

Procedure

1. Write the name of the food you are testing on each square of paper (one food per square).

2. Rub or drip some of the food sample on one square of the paper. Repeat with the other food samples on separate squares of paper.

3. Drip water on another square.

4. Allow all the squares to dry.

5. Shake off any excess food sample.

6. Hold the squares up to the light.

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Observations

1. Can you see light through any of the spots?
2. Do any of the spots look greasy?
3. What happened to the water spot?
4. Record your observations on the Experiment Data Sheet. Fat will leave a spot that allows light to pass through.

Test Station 3
Protein

Materials and Equipment

Paper and pencil

Food samples to test

Fork

Container of water

Small glasses or paper cups (one for each food sample being tested)

2 eyedroppers

Copper sulfate solution (3 percent copper sulfate in water)

Household ammonia

(Be careful! Copper sulfate and ammonia are poisons. Do not eat any of the foods used in this test.)

Procedure

1. Before testing solid foods, mash them with the fork and mix them with a small amount of water.
2. Put each food sample in a separate glass or paper cup. Using one of the eyedroppers, add a few drops of copper sulfate solution to each test solution. With the other eyedropper, add a few drops of ammonia to each solution.
3. Watch for a color change. A dark violet color indicates protein is present.

Observations

1. Did any of the test solutions change to a dark violet color?
2. Record your observations on the Experiment Data Sheet.

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Name_____ K

Experiment Data Sheet

Food sample tested	Nutrient tested	Results of test (Write down any changes you noticed)	Nutrient present (Circle one)
1.			YES NO
2.			YES NO
3.			YES NO
4.			YES NO
5.			YES NO

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Name_____

Water Moves the Goods

Did you know that water is our most important nutrient? None of the other nutrients would be much good to us without it because water is what takes those nutrients to the cells in all parts of our bodies.

Plants use water, too, for transporting nutrients from their roots to their stems and leaves. You can see how this transportation system works in this experiment with celery.

Materials

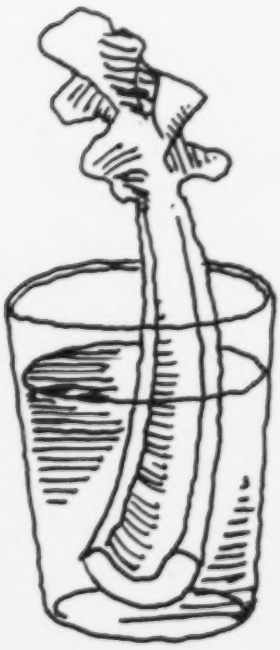
Pencil and paper
Red or blue food coloring
A glass half full of water
Stalk of celery with leaves
Knife

Procedure

1. Add the food coloring drop by drop to the glass of water until the solution is a medium dark color.
2. Put the stalk of celery into the colored water so that at least half of the celery, including the leaves, extends above the water.
3. Wait two hours and record what you see.
4. Cut the celery in half crosswise and draw what you see.

Observations

1. Can you see any color change in the stalk? In the leaves?
2. What does the cross-section of the stalk look like?
3. Pretend that the food coloring you added represents nutrients from the soil. What does the water do in this experiment?



Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Name_____

Finding Food's Hidden Water

Every day your body loses more than two quarts of water in your sweat, your breath, and your urine and feces. All you have to do to replace that water is to drink half a gallon every day. Right? *Drinking plenty of liquid is important.* But did you know your body can replace as much as one quart of that water even when you don't drink a drop? That is because there is some water in everything you eat. These experiments will help you find where it is hiding.

Part 1

Materials

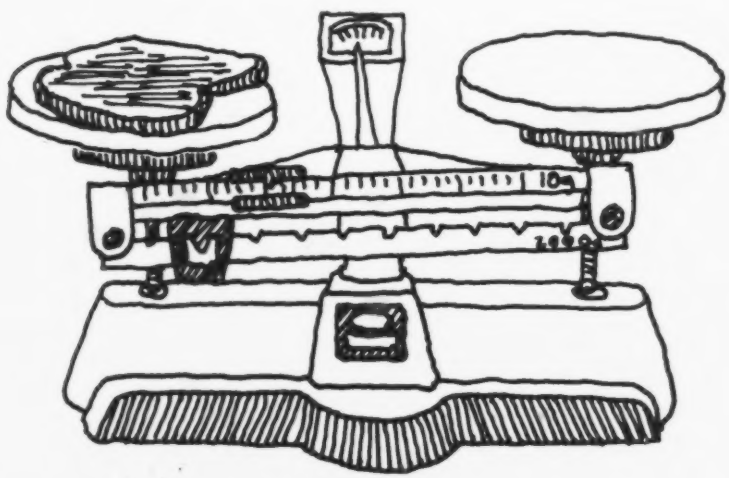
Pencil and paper
Slice of bread
Balance or diet scale
Countertop toaster oven
Plate

Procedure

1. Weigh the slice of bread on the scale. Record the weight. Then toast it on a medium setting in the toaster oven.
2. Take the hot toast out and lay it on a plate. Wait two to three minutes, then lift the toast and feel the plate underneath the toast. Weigh the toast and record the weight.
3. Return the toast to the oven. Leave the oven on "low" or "warm." Check the toast in 30 minutes. Weigh it again and record.

Observations

1. What did you feel on the plate underneath the toast?
2. What was happening to the toast? What was it losing?
3. What was the difference in weight before and after toasting? After 30 minutes in a warm oven?



Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Part 2

Materials

Pencil and paper

Freeze-dried or dehydrated foods such as

- Dried fruits
- Foil pouches of campers' and backpackers' food
- Dry peas and beans
- Condensed mincemeat for pies

Balance or diet scale

Several small bowls (enough for each food)

Water

Procedure

1. Examine the foods. Pick up a sample. Feel it. Taste it. Record your reactions.

2. Weigh a sample of each food. Record the weight. Place each sample in a separate bowl.

3. Add water to each bowl until the food is covered. Allow the food to soak. Or rehydrate (put water back) according to package directions. Check what has happened in 30 minutes. An hour. The next day.

4. Weigh the samples again. Record the weights.

Observations

1. Describe the dried samples that you felt and tasted. How was each dried food different from its fresh version?

2. How much did each sample weigh dry? After you rehydrated it?

3. What percentage of each rehydrated food was water? To find the answer, follow these steps:

   a. Subtract the weight of the dried food from the weight of the food after it was rehydrated. (This figure is the weight of the water added back.)

   b. Now divide the weight of the water by the weight of the rehydrated food. Multiply your answer by 100. (This answer is the *percentage* of water in the rehydrated food.)

   Example: Your sample weighed 10 grams dry.
   It weighed 50 grams after you rehydrated it.
   The water added must have weighed 40 grams.
   40 divided by 50 = .80
   .80 times 100 = 80%

   The rehydrated food is 80 percent water.

4. Why are freeze-dried and dehydrated foods popular for camping and backpacking?

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Part 3

This part of the experiment should be set up on the first day and checked over the next several days.

Materials

Pencil and paper

Knife

Fresh potato

Balance or diet scale

2 plates

Fresh spinach or parsley leaves

Procedure

1. Cut the potato into thin slices. Weigh the slices and record the weight. Put the slices on a plate and set in a warm place to dry. When they are dry, weigh them again. Record the weight.

2. Determine how much of the potato's original weight was water.

   Example: If a slice of potato weighed *3 grams* to begin with and only *1 gram* after drying, the weight of the water lost would be *2 grams*. The original potato would have been two-thirds water.

3. Repeat the experiment with fresh spinach or parsley leaves.

Observations

Which food contains the greatest proportion of water?

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Name_____

Apple Head Dolls

Apple head dolls have been a folk art favorite for hundreds of years. They are easy to make simply by removing water from the apple.

Materials

Round, smooth apple

Paring knife

Small bowl of lemon juice

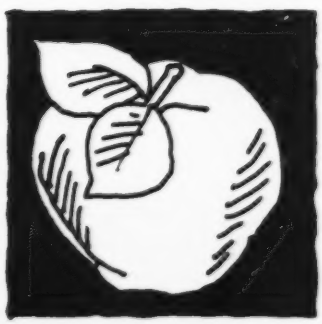
String

Whole cloves

Cotton balls or polyester fiberfill

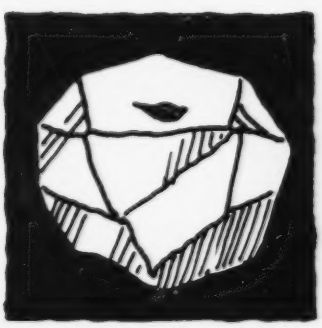
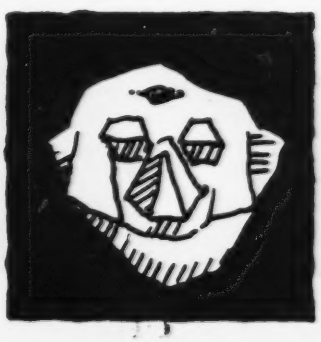
Craft glue

Optional: miniature wire rim glasses, corncob pipe, straw hat, bonnet, and other accessories for the finished doll



Procedure

1. Carefully peel the apple with the paring knife. Leave the stem and some peel at the top of the apple.
2. Carve a simple face with deep eye sockets, rounded cheeks, a nose, mouth, and lines in the forehead. The features should be exaggerated so they will show up well after the apple dries.
3. To prevent the apple from darkening, dip it in the lemon juice. (If you want the doll to have darker skin, skip this step.)
4. Tie the string to the apple stem. Hang the apple in a warm, dry place out of direct sunlight. Drying will take two to four weeks. (To speed up the drying process, place the apple in a gas oven for about two days. The warmth from the pilot light will dry the apple more quickly than room air.)
5. After the apple head has dried completely, push a clove into each eye socket. Create hair by gluing cotton or fiberfill to the head.
6. Add other accessories to make the doll look like an old lady or an old man. You may even make a body for the doll, if you want to.

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

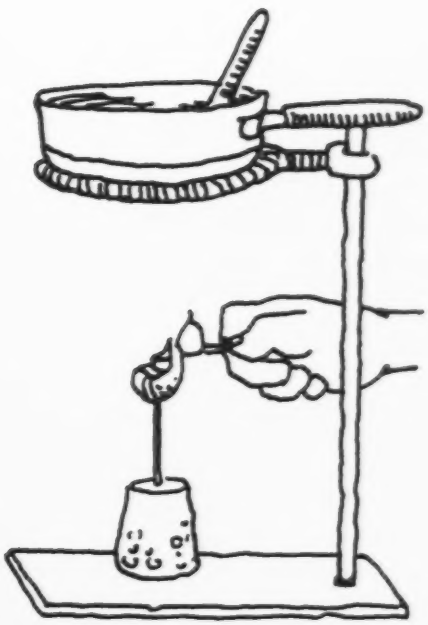
Name_____

Making a Calorimeter to Count Calories

A Calorie is a unit of heat that is used as the measure of the amount of energy in a food. Food scientists can tell how many Calories a food has by burning the food in a special device called a calorimeter. You can make a simple version of a calorimeter and use it to get an idea of how much energy is stored in a walnut.

Materials

Pencil and paper
Large shelled walnut half
Long needle
Cork
Ring stand
One-liter measuring cup
Water
Shallow saucepan
Celsius thermometer
Matches



Procedure

1. Stick the walnut half on the point of the needle. Then push the other end of the needle into the cork. Place the cork and walnut on the base of the ring stand with the walnut pointing up.
2. Pour one liter (one kilogram) of water into the saucepan and place the saucepan on the ring stand above the walnut.
3. Record the temperature of the water. (It should be at room temperature.)
4. Have your teacher light the walnut with a match. The burning walnut will release energy to heat the water.
5. As soon as the walnut stops burning, check the temperature of the water again.
6. Subtract the water temperature reading before burning from the one after burning. The difference is the amount of energy (Calories) released by the walnut.

Observations

1. How many Calories did your walnut contain?
2. Some heat is lost into the air and into the metal on the ring stand and saucepan. Does this mean your walnut actually contained more or fewer Calories than you were able to measure?

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Fat in Foods

(in grams)

Whole milk, 1 cup	8 g
2 percent milk, 1 cup	5 g
Nonfat milk, 1 cup	0 g
Processed American cheese, 1 ounce	9 g
Cheddar cheese, 1-inch cube	6 g
Ice cream, 1 cup	14 g
Ice milk, 1 cup	6 g
Egg, whole	6 g
Bacon, 2 slices	8 g
Hot dog, 1	15 g
Chicken drumstick, fried, 2 ounces	4 g
Pork chop, loin, broiled, 2.7 ounces	25 g
Pizza, 1 slice	4 g
Hamburger patty, broiled, 3 ounces	15 g
Coconut, 2" x 2" x 1/2" piece	16 g
Peanuts, 1/2 cup	36 g
Peanut butter, 1 tablespoon	8 g
Avocado, California, 10 ounces	37 g
Olives, green, 8 medium	4 g
Brownie, 1 3/4" x 1 3/4" x 7/8"	4 g
Milk chocolate candy, 1 ounce	9 g

All foods are ready-to-eat. Values taken from ***Nutritive Value of Foods***, USDA Home and Garden Bulletin 72.

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Dear Parent,

As a part of our study of nutrition, we are talking about how our food habits affect dental health. Foods, especially sugary foods, leave decay-causing residue on the teeth long after they have been eaten.

In class we are asking each child to chew a dental disclosing tablet. These tablets leave a red color wherever invisible food residues have built up on the teeth, most often around the gums and between teeth.

You may be startled to see the color on your child's teeth, but it is harmless and will come off with brushing. Dentists and health educators have found that the tablets provide a dramatic lesson for children about the need for good dental and eating habits.

Your child may come home excited about this activity and want to try it on other members of the family. By using the tablets at home occasionally, you can see if your child's dental habits are improving. Dental disclosing tablets are inexpensive and available at most pharmacies.

We would like your permission to have your child participate in this activity at school. Your child may bring a toothbrush to school to remove the color, although this is not necessary.

Sincerely,

- - - -

Queridos Padres:

Como parte de nuestros estudios en nutrición estamos discutiendo la forma en que los hábitos de comer afectan el estado de nuestra dentadura. Los alimentos, especialmente los que contienen azúcar, dejan residuos en los dientes los cuales causan caries mucho tiempo después de comerlos.

En la clase estamos pidiendo a cada estudiante que mastique una tableta la cual revelará los residuos de alimentos. Estas tabletas dejan un color rojo dondequiera que se hayan acumulado residuos invisibles de comida; con más frecuencia alrededor de las encias y entre los dientes.

Usted puede que se sorprenda al ver a su niño (o niña) con color en los dientes, pero éste no es perjudicial y le saldrá con sólo cepillarselos. Dentistas y educadores han encontrado que dichas tabletas dramatizan la necesidad de desarrollar buenos hábitos de comer y de cuidar los dientes, lo que resulta en una buena lección para los niños.

Su niño (o niña) puede que llegue a su casa excitado con esta actividad y quiera practicar con otros miembros de la familia. El uso ocasional de estas tabletas en el hogar, le indicará si su niño (o niña) está progresando en sus hábitos de cuido dental. Estas tabletas son baratas y se pueden obtener en casi todas las farmacias.

Quisiéramos tener su permiso para que su niño (o niña) participe en esta actividad en la escuela. Los niños podrán traer sus propios cepillos de dientes a la escuela para quitarse el color rojo; aunque no es necesario.

Sinceramente,

- -

Mi niño (niña) _____ tiene permiso para participar
(nombre)
en el proyecto dental, usando tabletas reveladoras de residuos, en la escuela.

_____
(firma del padre o de la madre)

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Sugar—A Congressional Hearing

The purpose of this mock hearing is to debate a proposal to add the following warning label to foods containing sugar:

PROPOSED WARNING: "This product contains x % sugar. Frequent use contributes to tooth decay and other health problems."

Materials

A copy of the testimony for each student

Procedure

1. Ask for six volunteers to role-play witnesses at the congressional hearing. Each witness should be assigned an aide to help research and discuss testimony.

2. Appoint three students to be members of the congressional committee: Senator A is from Hawaii (a principal sugar-producing state); Senator B is an outspoken consumer advocate; Senator C is particularly interested in medical care.

3. Ask the class to keep the following questions in mind while listening to the testimony of each witness: Does the witness support or oppose placing a warning on foods containing sugar? What are his/her major reasons for this position? What interests does this person represent? How are these interests reflected in the testimony? What questions would you like to ask this person? Is this witness omitting important facts from his/her testimony?

4. Give each witness a copy of his/her testimony.

5. Allow students time to consult with their aides, to do further research if necessary, and to prepare for the hearing.

6. Each witness will make a statement. Class members may ask questions to clarify opinions and facts. The students appointed as senators may ask additional questions related to the issue.

7. At the close, each senator should make a position statement.

8. Discuss the questions in step 3 above. Which testimony did students find most convincing? Which did students find least convincing?

9. Follow-up: What is the purpose of a congressional hearing? Is it to make a decision at the time? Or is it to listen only? Do you think that government officials use the information disclosed in a public hearing? Are they required by law to consider it? What pressures might convince public officials to ignore public opinion? Do you feel helpless about influencing decision makers? Is there some way that you can strongly affect decision makers? Who else should have testified at this hearing?

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Science, Cornell University, 1986.

Who do you think should make decisions regulating the quality and advertising of food? Government? Industry? Consumers? Who should make decisions on the following issues: use of food additives in food, the type of food available in public schools, extensive advertising of sugary foods on TV programs for children?

Testimony

A. REPRESENTATIVE OF A NATIONAL ADVERTISING ASSOCIATION

Advertising plays an important role in the American economy. Consumers are exposed to the full range of items available and can make intelligent, deliberate choices based on the information provided by advertisements.

The advertising of sugar and sweets should not be hampered by a warning that wrongly scares consumers. Sugar, when consumed in moderate amounts, is a healthful and delicious food.

Advertisements that claim sugar is an energy food, necessary for our busy lives, are neither false nor misleading. Of course, sugar is only one component of a well-balanced diet. Excessive use can be harmful to one's health, as can overuse of other foods. It is the individual's responsibility to monitor his or her diet.

B. PRESIDENT OF SWEETO SUGAR COMPANY

Carbohydrates are a necessary source of nutrients. About one-third of the carbohydrates consumed by Americans is sugar. Without it we would have a hard time getting enough Calories and might burn protein for Calories instead of sparing protein to build tissues and enzymes. Sugar is usually eaten with a nutritious food such as milk. It makes many otherwise ordinary and boring foods tasty and exciting, especially for young children. Sugar provides jobs; it is important to our economy and is an important commodity in world trade.

C. PRESIDENT OF SWEETEE CANDY COMPANY

Today's Americans do adore sweets, but sugar consumption has not changed in the last forty years. Sugar intake has remained stable for a good while. The candy bars we manufacture provide that special energy lift so important for growing children and busy adults. Sugar adds to the enjoyment and the texture of foods. We all know that we eat because we like to, not just to provide nutrients for our bodies. The benefits of sugar are obvious to us all. Although sugar is often cited as a cause of tooth decay and obesity, a combination of complex forces is responsible for these diseases that are unfairly attributed to sugar itself.

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

D. NUTRITIONIST

Health professionals have long agreed that sugar is a major factor in tooth decay. Some evidence also links sugar to a variety of diseases, including diabetes. Sugar provides empty calories—it contains no vitamins, minerals, or proteins, and it squeezes more nutritious foods out of the diet. In 1880 the average American ate forty pounds of sugar per year; in the 1970s this had risen to over one hundred pounds per year. We don't need sugar! Starches such as cereals, potatoes, and fruits are better sources of carbohydrates—these foods contain valuable nutrients and are less harmful to our teeth and bodies.

E. DENTIST

Dental caries (the technical name for cavities) afflicts 98 percent of the U.S. population. The last comprehensive government survey revealed that an adult has an average of 18 decayed, missing, or filled teeth (out of 32). Dental problems can cause pain, infections, chewing impairment, and malnutrition, and they are costly. America's dental bill is $3 billion yearly, and many dental problems remain untreated. Studies have shown conclusively that sucrose is the major factor in tooth decay. The stickiness of sweets and the frequency with which they are eaten also determine the likelihood of decay. The safest precaution is to avoid all foods with added sugar.

F. CONSUMER REPRESENTATIVE

Consumers need informative advertising and labeling so they can make sensible food choices based on facts. It is not only what is included in ads that is important, but also what is left out. "It isn't just good flavor, it's good food" is one of the slogans of the sugar industry. This is a highly disputed, misleading statement that ignores known dangers of sugar consumption. "Sugar isn't the only nutrient in an ice cream cone," says another advertising line, implying that sugar is a nutrient, a debatable claim. Sugar supplies nutrients only if one considers Calories a nutrient. Sugar consumption has increased dramatically in the last one hundred years, and Americans consume more and more sugar unknowingly in processed foods from ketchup to kidney beans. Consuming sugar is no longer a matter of choice. It is the corporation's responsibility to provide truthful and complete labeling, even if this reveals the potential hazards of a product.

Reprinted with permission from ***Food: Where Nutrition, Politics and Culture Meet,*** © Center for Science in the Public Interest, 1501 16th Street, N.W., Washington, D.C. 20036.

Protein Match Game

Cut out the puzzle pieces below. Write the name of a food you like on each of the puzzle pieces. For example, you might write "bagel" on the piece labeled "grain," "refried beans" on the legume piece, "cheddar cheese" on the piece for milk products, and "walnut" on the piece for nuts and seeds.

Your teacher will explain what to do with your finished puzzle pieces.

Nonmeat Protein Sources

Grains
Bagel
Banana bread
Barley
Biscuits
Brown bread
Bulgur
Corn bread
Date-nut bread
English muffin
French bread
Grits
Macaroni
Noodles
Oatmeal
Pancakes
Pie crust
Pita
Pumpernickel bread
Rice
Rye bread
Soda crackers
Spaghetti
Tortilla
Whole wheat bread

Milk Products
Buttermilk
Cheddar cheese
Cottage cheese
Mozzarella cheese
Parmesan cheese
Pot cheese
Processed cheese food
Ricotta cheese
Skim milk
Swiss cheese
Whole milk
Yogurt

Legumes
Aduki beans
Baked brown beans
Black beans
Black-eyed peas
Chick-peas (garbanzos)
Great Northern beans
Kidney beans
Lentils
Lima beans
Navy beans
Pinto beans
Refried beans
Soybeans
Split peas
Tofu (soybean curd)

Nuts and Seeds
Almonds
Brazil nuts
Cashews
Caraway seeds
Chestnuts
Hazelnuts
Macademia nuts
*Peanuts
Pecans
Pistachios
Poppy seeds
Pumpkin seeds
Sesame seeds
Sunflower seeds
Walnuts

*Peanuts are actually a legume, but their amino acid profile is more like that of nuts and seeds.

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Protein in Foods

(in grams)

Milk Products	
Cheddar cheese, 1-ounce piece	7 g
Low-fat cottage cheese, 1/2 cup	15 g
Part-skim mozzarella cheese, 1 ounce	8 g
Grated parmesan cheese, 1 tablespoon	2 g
Pasteurized process American cheese, 1-ounce piece	6 g
Whole milk, 1 cup	8 g
2 percent milk, 1 cup	8 g
Buttermilk, 1 cup	8 g
Chocolate milk, 1 cup	8 g
Eggnog, 1 cup	10 g
Vanilla milk shake, 11 ounces	12 g
Ice cream, 1 cup	5 g
Chocolate pudding, 1/2 cup	4 g
Baked custard, 1/2 cup	7 g
Fruit-flavored yogurt, 8 ounces	10 g
Eggs	
Large egg	6 g
Egg white	3 g
Egg yolk	3 g
Fish, Meats, Poultry	
Baked bluefish, 3 ounces	22 g
Fish sticks, 3 ounces	15 g
Fried haddock, 3 ounces	17 g
Canned salmon, 3 ounces	20 g
Canned sardines, 3 ounces	20 g
Fried scallops, 6	16 g
Fried shrimp, 3 ounces	17 g
Canned tuna, 3 ounces	24 g
Tuna salad, 1/2 cup	15 g
Bacon, 2 slices	4 g
Beef, 3 ounces	23 g
Hamburger patty, 3 ounces	20 g
Canned corn beef, 3 ounces	22 g
Beef and vegetable stew, 1 cup	16 g
Chili con carne, 1 cup	19 g
Roast lamb, 3 ounces	22 g
Beef liver, 3 ounces	22 g
Ham, 3 ounces	18 g
Boiled ham lunchmeat, 1 ounce	5 g
Pork chop, 2 ounces	18 g
Bologna, 1 ounce	3 g
Brown and serve sausage, 2 links	6 g
Hot dog, 1	7 g
Veal cutlet, 3 ounces	23 g
1/2 chicken breast, 3 ounces	26 g
Chicken drumstick	12 g
Chicken and noodles, 1 cup (home recipe)	22 g
Roast turkey, chopped, 1/2 cup	22 g
Grains	
Bagel, 1	6 g
Barley, 2 tablespoons	2 g
Biscuit, 2-inch diameter	2 g
Boston brown bread, 1 slice	2 g
Cracked wheat bread, 1 slice	2 g
French or Vienna bread, 1 slice	2 g
Italian bread, 1 slice	2 g
Raisin bread, 1 slice	2 g
Rye bread, 1 slice	2 g
Pumpernickel bread, 1 slice	3 g
Enriched white bread, 1 slice	2 g
Whole wheat bread, 1 slice	3 g

Grits, 1 cup	3 g
Farina, 1 cup	3 g
Oatmeal, 1 cup	5 g
Bran flakes, 1 cup	4 g
Corn flakes, 1 cup	2 g
Puffed oats, 1 cup	3 g
Wheat flakes, 1 cup	3 g
Wheat germ, 1 tablespoon	2 g
Angelfood cake, 1/12 of a tube cake	3 g
Chocolate cupcake, 1	2 g
Oatmeal cookies with raisins, 1	3 g
Saltine crackers, 4	1 g
Rye wafer, 1	1 g
Graham crackers, 2	1 g
Macaroni, 1/2 cup	2 g
Muffin, 1 (blueberry, corn, or bran)	3 g
Egg noodles, 1/2 cup	3 g
Buckwheat pancakes, 2	4 g
Plain pancakes, 2	4 g
Pie crust, 1/6 pie	2 g
Cheese pizza, 1 piece	6 g
Popcorn, 1 cup	1 g
Soft pretzel, 1	2 g
Thin pretzel twists, 10	6 g
Rice, 1/2 cup	2 g
Cloverleaf roll, 1	2 g
Hamburger or hot dog roll, 1	3 g
Hard roll, 1	5 g
Spaghetti	
with tomato sauce and cheese, 1 cup	9 g
canned, 1 cup	6 g
Waffles, 1 7-inch	7 g
Legumes, Nuts, and Seeds	
Almonds, chopped, 1/4 cup	6 g
Dry beans, 1/2 cup	7 g
Brazil nuts, 6 to 8	5 g
Cashew nuts, roasted, 1/4 cup	1 g
Filberts (hazelnuts), chopped, 1/2 cup	3 g
Lentils, 1/2 cup	8 g
Peanuts, roasted, 1/2 cup	18 g
Peanut butter, 1 tablespoon	4 g
Split peas, 1/2 cup	8 g
Pecans, chopped, 1/2 cup	11 g
Pumpkin kernels, 1/4 cup	10 g
Sunflower seeds, 1/4 cup	9 g
Walnuts, chopped, 1/4 cup	6 g
Vegetables	
Lima beans, baby, 1/2 cup	7 g
Snap beans, 1/2 cup	1 g
Bean sprouts, 1/4 cup	1 g
Black-eyed peas, 1/2 cup	7 g
Broccoli, 1 medium stalk	6 g
Corn, 1 ear	4 g
Green peas, 1/2 cup	4 g
Baked potato, 8 ounces	4 g
Spinach, 1/2 cup	3 g
Sweet potato, 5 inches by 2 inches	2 g

All foods are ready-to-eat. Values taken from ***Nutritive Value of Foods***, USDA Home and Garden Bulletin 72.

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Name_____

Where's the Protein?

Study the ingredients in the two recipes below. Look for the ones that supply protein. Then answer the following questions.

1. Which recipe has ingredients that will supply all eight essential amino acids?

   _____

   What two ingredients in this recipe contain protein?_____

   and _____

   Which protein combination does this recipe supply? (Check one.)

   _____ a. Grain and legume

   _____ b. Grain and milk

   _____ c. Legume and seed

2. Which recipe would *not* supply all eight essential amino acids? _____

   What food could you serve *with* the dish so you *would* have all the eight essential amino acids?

   _____

Frijoles

1/2 cup dried pinto beans
2 cups water
1/2 teaspoon salt
1/2 teaspoon chili powder
1/8 teaspoon cayenne pepper
1/4 cup onion, chopped
1/2 cup cooked tomatoes
1/4 cup celery, chopped
2 cups cooked enriched rice

Add water to beans, bring to a boil, cover, and cook 2 minutes. Remove from heat and let soak 1 hour. Add salt, chili powder, cayenne pepper, onion, and tomatoes. Cook, covered, stirring occasionally, until beans are tender (about 2 hours). Add more water, if needed. Add celery about 15 minutes before beans are cooked. Serve on rice. Makes 3 to 4 servings.

Pineapple Banana Shake

4 to 6 ounces soft tofu (soybean curd)
1 cup crushed pineapple with juice
1/2 cup orange juice
1/2 medium banana

Place all ingredients in a blender and process until smooth. Thin with more fruit juice, if desired. Refrigerate. Serve chilled. Makes 2 cups.

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Name_____

Vitamin C

Vitamin C is just one of the vitamins your body needs to stay healthy. Probably the most important job vitamin C has is to help make the collagen or "glue" that holds the cells of your body together. Vitamin C is called a "water-soluble vitamin" because it dissolves in water. Your body can't store this vitamin so you need a fresh supply every day from the foods you eat.

This experiment will help you discover whether a food contains vitamin C.

Materials

Paper and pencil
Stirring spoon
Measuring spoons
Measuring cup
Cornstarch
Water
Saucepan
Stove or hot plate
3 glass jars with lids
Several glasses or paper cups (enough for each food being tested)
2 eyedroppers
Iodine (Be careful. Iodine is a poison and can stain hands and clothing.)
250-mg vitamin C tablet, crushed
Foods to test for vitamin C such as fruit juices, milk, soft drinks, and beef broth.
(Beverages and liquids will be easier to compare than solid foods.)
Orange juice

Procedure

1. First make an "indicator." This is the substance you will use to test for the presence of vitamin C in different foods. The indicator will change color if vitamin C is present.

   a. Stir 1/2 teaspoon cornstarch into 1 cup of water in a saucepan. Heat the mixture over low heat until the cornstarch is completely dissolved, stirring constantly. The mixture will turn from cloudy to clear as the cornstarch dissolves. Cool the mixture slightly and pour it into a jar. Thoroughly rinse the saucepan and the spoon.

   b. Pour 1 cup of water into a glass. Stir in 1 teaspoon of the cornstarch mixture. Using an eyedropper, add 6 drops of iodine. Mix thoroughly. The mixture should turn blue. This is your indicator solution.

2. Next do a *positive test* for vitamin C. In this test, you will add vitamin C to the indicator solution to see what happens. In step 3 you will compare your results with the results of this positive test.

   a. Dissolve the crushed vitamin C tablet in 1 cup of warm water.

   b. Put 4 tablespoons of the indicator solution in a glass. Using a *clean* eyedropper, add 1 drop of the vitamin C solution. Stir. Add more vitamin C solution, drop by drop, until the blue color *disappears*. Record the number of drops of vitamin C solution you added. Carefully rinse the eyedropper and stirring spoon before going on.

3. Test the other foods for vitamin C in the same way. Use a different glass of indicator solution for each new food. Record the number of drops of each food sample you added. If the blue color does not disappear, the food sample contains no vitamin C. Rinse the eyedropper and spoon after each test.

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

4. Measure 1 cup of orange juice. Test the juice for vitamin C. Pour *half* of the juice into the saucepan. Bring to a boil. Cool to lukewarm. Do the test for vitamin C on the boiled juice.

5. Pour the other half of the juice (*not* boiled) into two glass jars, 1/4 cup juice per jar. Cover each jar with a lid. Store one jar overnight in a dark cupboard. Store the other jar in bright light. After 24 hours, test each sample again.

Observations

1. What happened to the color of the indicator solution in each test you did? If the blue color disappeared, how many drops of the test liquid did you add to get that result?

2. What happened to the color of the indicator when you added the *boiled* orange juice? Why?

3. Did the juice samples in the two jars have as much vitamin C after they were stored as they did the first day? Which of the two samples had more vitamin C on the second day? How do you explain those results?

Foods Tested for Vitamin C	Number of Drops Added	Vitamin C Present? Yes	No
1. Vitamin C tablet			
2. Orange juice			
3. Boiled orange juice			
4. Orange juice stored in dark			
5. Orange juice stored in light			
6.			
7.			
8.			
9.			
10.			

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Name_____

Vitamin C as an Antioxidant

Some sliced fruits turn brown when exposed to the oxygen in the air. Brown fruit does not look very appetizing. To prevent the reaction with oxygen, the fruit must be treated with a chemical called an antioxidant. In this experiment, you will see how ascorbic acid (vitamin C) can be used as an antioxidant.

Materials

Paper and pencil

Measuring cup

Fruit Fresh (A "fruit protector" available in the supermarket. Ever Fresh is a similar product.)

Water

Mixing spoon

Knife

Fresh peach, banana, or apple

3 small bowls

Orange juice or pineapple juice

Procedure

1. Dissolve 1/3 cup of Fruit Fresh in 1 cup of water. Set aside.
2. Peel and slice the fruit. Put a few slices in each of the three bowls.
3. Pour a little plain water over the fruit in one bowl. Stir to coat the fruit well. Label this bowl "Water." (This fruit is the "control" for your experiment. You will check your results in steps 4 and 5 against the results in this step.)
4. Coat the fruit in the second bowl with the Fruit Fresh solution. Label this bowl "Fruit Fresh." Rinse the spoon well.
5. Coat the fruit in the third bowl with the orange or pineapple juice. Label this bowl "Juice."
6. Allow the three bowls to stand at room temperature for 30 minutes. Record any changes you notice. Check again in 1 hour.

Observations

1. What happened to the fruit treated with water?
2. What happened to the samples treated with Fruit Fresh and juice? Was there any difference between the two samples?
3. What chemical ingredient do the two test mixtures (Fruit Fresh and juice) have in common?

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Name_____

What's in It?

Using the food composition table, find the answers to the following questions.

1. How many Calories are there in a cup of

   whole milk? _____

   In a cup of chocolate milk? _____

   In a cup of skim milk? _____

   Which one would you choose for breakfast for someone who needs to cut down on Calories?

   _____

2. How much iron is there is a serving of chili

   con carne with beans? _____ mg

   In a serving of baked beans in pork and

   tomato sauce? _____ mg

   Which food has more iron? _____

3. How much vitamin C is there in an orange?

   _____ mg

   In a banana? _____ mg

   In a quarter of a cantaloupe? _____ mg

   In an apple? _____ mg

   How many pieces of cantaloupe would you have to eat to get about as much vitamin C

   as there is in an orange? _____

   How many bananas would you have to eat?

   _____

   How many apples? _____

4. Find green beans and green peas in the tables.

   Which one has more Calories? _____

   Which one has more calcium? _____

   Which one has more vitamin A? _____

   Compare both vegetables with broccoli. Which of the three vegetables has the most calcium and vitamins A and C?

   _____

5. You have a choice of a baked potato with 1 tablespoon of margarine, 20 potato chips, or McDonald's regular fries.

   Which choice would give you the most

   vitamin C? _____

   Which one has the fewest Calories? _____

   _____

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Name_____ **Age**_____

It All Adds Up

Use the Recommended Dietary Allowances (RDAs) and the food composition table to find the answers to the following questions.

1. How many milligrams of vitamin C do you need each day? _____ mg

   Suppose you are allergic to oranges. What single food or combination of foods could you eat today that would give you all the vitamin C you need?

Food	Vitamin C
_____	_____ mg
_____	_____ mg
_____	_____ mg

(Add more lines if you need to.)

2. How many milligrams of calcium do you need? _____ mg

   You have discovered that drinking milk causes you to have stomach cramps. The doctor says you should avoid drinking milk, but you can eat yogurt and cheese. List the foods you will eat today to get the calcium you need.

Food	Calcium
_____	_____ mg
_____	_____ mg
_____	_____ mg

(Add more lines if you need to.)

3. You had carrot sticks (from a 5-inch carrot) for lunch. How much more vitamin A do you need today?_____

4. How many milligrams of iron do you need each day? _____ mg

   You had the following foods for breakfast: 3/4 cup of corn flakes
   1 medium banana
   1/2 cup whole milk

   Have you had enough iron for the day? _____ (Add up the iron for each of these foods and subtract the total amount from your RDA for iron.) If you haven't had enough iron, how much more do you need? _____ mg

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Food Groups*

	Choose These Foods Anytime	Choose These Foods Sometimes	Choose These Foods Only as Occasional Treats
Vegetables and Fruits Vitamins A and C, dietary fiber 4 servings a day	Canned fruit (in juice) Fresh fruits and vegetables Frozen vegetables Unsweetened fruit juices	Canned or frozen fruit in syrup or sugar Canned vegetables (salt added) Dried fruits Sweetened fruit juice	French fried potatoes Olives Pickles Potato chips
Bread and Cereal Carbohydrate, B vitamins, iron, some protein 4 servings a day	Oatmeal Pasta Whole grain breads and cereals	Granola Low-sugar cereals White bread	High-sugar cereals
Milk and Cheese Protein, calcium, vitamin A, riboflavin, and vitamin D (if milk is fortified with vitamin D) 3–4 servings a day	Buttermilk Cottage cheese Low-fat or skim milk Plain yogurt Skim milk cheeses	Hard cheeses such as cheddar and Swiss Frozen yogurt Sweetened yogurt Whole milk	Cheesecake Ice cream Ice milk Processed cheeses such as American
Meat, Poultry, Fish, Dried Peas and Beans Protein, thiamin, niacin, iron, and other minerals 2 servings a day	Chicken or turkey (skinless) Dried peas and beans Fresh or frozen fish Peanut butter Tuna (canned, drained)	Beef Chicken or turkey (with skin) Eggs Fish (canned, salted, pickled, or smoked) Lamb Pork	Bacon Hot dogs Lunch meats Sausage
Caution Calories but few nutrients		Mayonnaise Margarine Vegetable oils	Butter Candy Cream Honey Jams and jellies Soft drinks Sugar Sweet toppings Unenriched, refined flour and baking products

***These groupings were developed by the U.S. Department of Agriculture for the typical American diet. They are often referred to as the Basic Four Food Groups or the Five Food Groups. Some charts divide fruits and vegetables into two groups according to the key nutrients they supply.**

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Name_____

What Did You Eat Today?

1. Keep a list of all the foods you eat today for meals and between-meal snacks.
2. Keep a separate list of any foods you throw away.
3. Put the foods in the proper categories on the chart below.
4. Count the number of servings you had in each food group.

	Vegetables and Fruits	Breads and Cereals	Milk and Cheese	Meat, Poultry, Fish, Dried Peas and Beans	Caution
	4 servings	4 servings	3 servings	4 servings	
Breakfast					
Lunch					
Dinner					
Snacks					
Foods I Threw Away					

Answer the following questions using the information on your chart.

1. Did you have more than enough servings from any of the groups?_____

   If so, which one(s)?_____

2. Did you have too few servings from any of the groups?_____

   If so, which one(s)?_____

3. How many servings did you have of foods in the "Caution" column?_____

4. Did you throw away more foods from one group than from any others? _____ If so, which one(s)?_____

5. Are your snacks all in the "Caution" column or do they add to the servings you need from the four main food groups? _____

6. Look at the food groups chart. What foods could you choose to complete your own food chart? (Add the new foods to your chart. Put a star next to them so you will be able to tell which ones you didn't actually eat today.)

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Situations

Situation 1

You have an older brother in eighth grade and a younger sister in third grade. The three of you live with your mother. You get home from school about two hours before your mother gets home from work. The first thing you usually do is raid the refrigerator for an after-school snack. Since your mother works long hours, she is sometimes too tired to start fixing dinner as soon as she walks in the door.

How could your family plan after-school snacks and dinners to be sure you are all sharing responsibility and getting a well-balanced diet, too?

Situation 2

You have started to pack your own bag lunches this year. Time is short in the morning so you want to make your job as easy as you can. Your mom says you can help choose what goes in your lunch, but she insists that the foods have to be "good for you."

Make up menus for five well-balanced bag lunches. Be as imaginative as you can, using a variety of foods in creative ways. Figure out what you can prepare ahead to save time in the morning. What special precautions will you have to take to keep your food from spoiling before lunchtime?

Situation 3

The school district has just announced that your school day will begin half an hour earlier next year. You already feel rushed trying to dress, eat breakfast, and get ready for the bus by 7:30. You have skipped breakfast a few times, but you were so hungry by 9:30 that you couldn't concentrate on anything but your stomach. Next year, you will have an even longer wait until lunch.

What can you do now to plan so your mornings won't be a disaster next year? What can you do to keep from starving by lunchtime?

Situation 4

Your class is going on an overnight campout at a nearby nature center. Your committee is in charge of planning the meals and buying the food for the whole class. You will have small camp stoves and running water at the campsite, but you must bring everything else you need.

List the factors you have to consider in planning what to take (such as lack of refrigeration). Then plan a menu for dinner the night you arrive, breakfast the next morning, and a lunch you can carry with you on a hike.

Situation 5

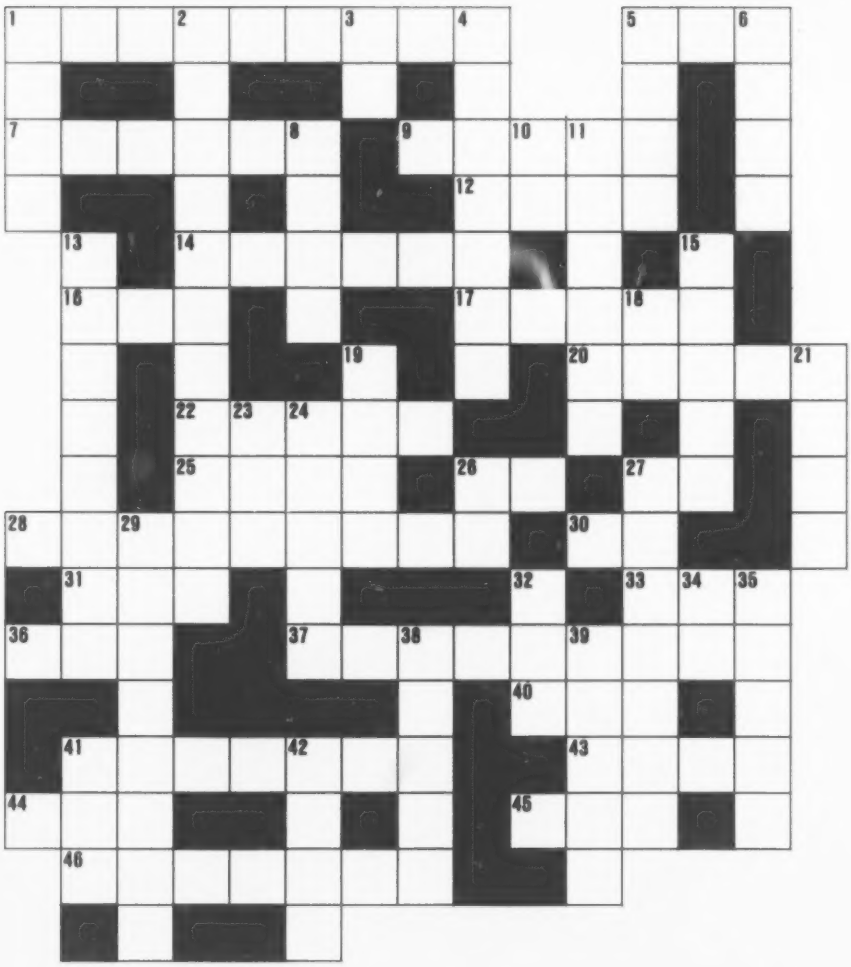
Your teacher has been talking about your nutrition unit at a faculty meeting. Other teachers are curious to find out what you have learned. One second grade teacher has invited a few of you to come to his classroom to talk about healthy snacks. You have decided you'll do more than talk about them. You'll show those little kids that snacks don't have to be sugary, salty, or fatty to taste great.

What five snacks will you choose that will be easy to make? What will you tell the second graders so they will know how to choose healthy (and tasty) snacks when you aren't around to help?

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

The Amazing Food Tube

Crossword Puzzle



Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

ACROSS

*1. The tube that carries food from the mouth to the stomach.

*5. One of the jobs of the stomach is to be a food-holding ———.

*7. ———is a nutrient that is partly digested in the mouth.

*9. A word often used to refer to the intestines.

12. A place where salt is dug out of the earth is called a salt ———.

*14. A liquid secreted in the mouth.

*16. The anus is where food waste passes ———of the body.

*17. The soupy mixture of food that leaves the stomach.

*20. A slippery coating in the nose, mouth, and digestive tract.

*22. An organ that stores nutrients and helps filter poisons.

25. A tiny cut.

26. A personal pronoun.

*27. The large intestine isn't as long ———the small intestine.

*28. A tiny blood vessel that picks up nutrients in the intestinal wall.

*30. The rectum ———a part of the large intestine.

*31. ———causes rumblings and burps.

*33. When you are frightened or nervous, you may get a funny feeling in the ———of your stomach.

36. A writing instrument.

*37. Most digestion happens in the small ———.

40. A term of respect for men.

*41. A nutrient that is broken down into amino acids in digestion.

43. A candy that is often eaten after meals.

44. A favorite American dessert.

45. First two-digit number.

*46. ———juices help digest food in the stomach.

DOWN

1. Opposite of difficult.

*2. The wavelike motion that keeps food moving through the digestive tract.

*3. Abbreviation for "gastro-intestinal."

*4. Ulcers are sores that sometimes occur on the lining of the ———.

*5. A chemical that helps break down fat into tiny droplets.

*6. The chemical in #5 DOWN is stored in the ———bladder.

*8. In the 1800s, Dr. Beaumont studied digestion through a ———in a man's stomach.

10. Abbreviation for West Indies.

*11. A body chemical that aids digestion and other body processes without being changed itself.

*13. Another name for fiber.

*15. The waste product that leaves the body after digestion.

18. A Greek leter.

19. The second letter in the Greek alphabet.

*21. Constipation can occur when peristalsis is too ———.

*23. Food poisoning can make you ———and may cause you to vomit.

*24. Tiny projections that absorb nutrients in the intestinal wall.

26. A personal pronoun.

27. A medicine that sometimes upsets the stomach.

*29. An organ that makes chemicals for digestion.

32. A donkey is sometimes called a jack ———.

34. The opposite of "out."

*35. The ———mash and tear food before it is swallowed.

38. A folk medicine that is supposed to improve bodily tone.

39. The New York ———has "all the news that's fit to print."

41. If a person eats too much, he may be compared with this animal.

*42. Eyes and ———help signal the brain that it is time to eat.

* Refers to information covered in Activity 15.

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

The Amazing Food Tube

Word Search Puzzle 1

Z N K J H A G W J D U J L D H E Z B
H F J L K L X T C N D Y D B T B P I
U E Q Z W D X O M I M J T L J S H B
V I L L I U I A I S V W F Z I H J O
I N N P B S B D C L D Q X Q L V C Q
Q W E C F H Q I W C U R C G H P E A
Y L J X R W F G Y B E K E C M R V R
S L D I C F C E H O R N A U I A Y C
I U S Q L M R S S T Y M T Z K L M S
P N V J I U A T H Q O C H B K Q A K
A Z T N M T X I R T E I H T K P N I
N S V E D J G O S R D B P V E M U V
C A Z L S V I N E S O P H A G U S J
R I H Y D T D S W P I X E M Q L N Z
E P W Y C U I F C L A W P Q K I Z P
A Y J N T G H N A K W I Z I V L Q S
S U M T Q R F J E M O U T H E Z P W
S E X M V K M Y Y C F U G I U R T X

There are 10 words hidden in this puzzle. The words may run horizontally, vertically, or diagonally. Here are the words to look for:

Anus
Digestion
Esophagus
Intestine
Liver
Mouth
Pancreas
Rectum
Stomach
Villi

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

The Amazing Food Tube

Word Search Puzzle 2

E R V S L D I C F G C H O R N I A Y C
U S Q L M R S T Y Z A K L M S V J I U
A H Q H B K Q K P Z N S M T X R I H T
A N U S K P I S E V D H T U O M J G D
B P V E M V A Z R S L V H R F E C E S
I J I H Y D D S I W U P I C I X E M Q
L N Z P W Y C U S F C G H L A C A W P
Q K I Z P Y J N T T G Y A V H M N A K
E N I E T O R P A W M I I H Z I O V L
Q M S U M T Q R L E F L J E P Z I T P
W S Y E X M V K S M A Y Y C F O T U S
G I U Z R T R X I S K Y X K M I S I X
I H A V N E L C S F H N F X B O E E J
D D V L V E K U S Y T U A F B O G G P
L G K I B U A Q K C Q C O P K K I H A
I M L E N I T S E T N I I P R S D B P
H F W Y T F L G O P C I T C E L Z F Q
I H T Q X W Y E Y N G Q K X M L T R P
I N J P A N C R E A S X V H V Q R N M

There are 16 words hidden in this puzzle. The words may run horizontally, vertically, or diagonally. Here are the words to look for:

Anus
Bile
Chyme
Digestion
Enzyme
Esophagus
Feces
Gastric
Intestine
Liver
Mouth
Pancreas
Peristalsis
Protein
Saliva
Stomach

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

DD

The Amazing Food Tube

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Name_____

Chew, Chew, Chew

Not so very long ago, children were told to chew each bite 32 times, or once for every tooth. This advice may be a little farfetched, but there is a good basis for it. Chewing breaks food into smaller pieces that are safer to swallow and easier for enzymes to digest. Try this test for yourself.

Materials

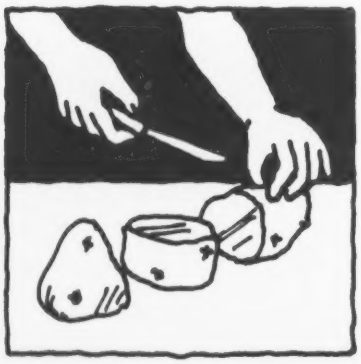
Pencil and paper
Potato
Peeler
Knife
3 jars with lids
Grater
Measuring cup
Water
Measuring spoons
3 glasses
Eyedropper
Iodine (Caution: iodine is a poison.)

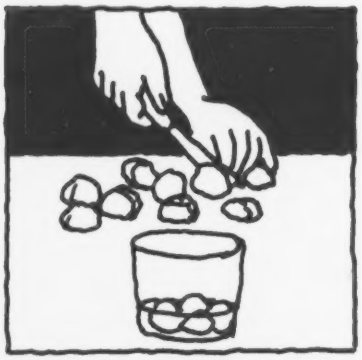
Procedure

1. Peel and cut the potato into three equal pieces.
2. Cut one of the thirds into bite-sized pieces and place in one of the jars.
3. Cut another third into smaller pieces and place in another jar.
4. Grate the last third and place the gratings in another jar.
5. Add 1/2 cup water to each jar. Cover with the lids. Shake each jar ten times.
6. Put 1 tablespoon of each water solution into three separate glasses. With the eyedropper, add 10 drops of iodine to each glass.

Observations

1. What did the mixtures look like before you shook them? What did they look like afterward?
2. What happened to each mixture when you added iodine?
3. Iodine turns dark blue when it comes in contact with starch. In which glass was the most starch released from the potato into the water?
4. Enzymes in the body must change the potato starch to a simpler form of carbohydrate. In which jar do you think the enzymes could begin their work most easily?





Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

The Man with a Hole in His Stomach

Studying digestion posed a challenge to scientists for a long time. It was frustrating to know that somehow food was broken down and turned into the "stuff of life" without being able to see *how* it happened. Cadavers weren't much help because digestion is a complex process that occurs only in living beings. Nature seemed determined to keep scientists in the dark.

Then a freak accident happened that finally shed some light on the mystery. In 1822, a young Canadian trapper named Alexis St. Martin was shot in the stomach during a scuffle at a frontier trading post in Michigan. An army doctor, William Beaumont, was miraculously able to save the man, but he could not completely close the gaping wound. St. Martin would have to live for the next sixty years with a permanent hole in his stomach. As "payment" for saving his life, Beaumont demanded that St. Martin become a living laboratory for studying how the stomach works—studies that Beaumont hoped would make him famous.

For years, the doctor pushed pieces of food through the hole in St. Martin's stomach and pulled them out again. He watched what happened when the man was happy or angry or upset. And he forced St. Martin to accompany him on long trips so that he could show other scientists how he carried out his unusual experiments.

Before Beaumont, most scientists thought the stomach digested food simply by mashing it. But one French scientist, René Réaumur, wasn't convinced. Like Beaumont, he suspected that a juice in the stomach was important in the digestive process.

In 1752, this Frenchman began experimenting with his pet bird, a kite. He stuffed bits of sponge into a soft tube with holes in it, then forced the tube down the bird's throat. Réaumur knew from experience that kites throw up anything they cannot digest. So it wasn't long before the bird obliged and returned the tube to his master. Aha! Just as Réaumur hoped, the sponges had soaked up some of the digestive juice he wanted. And best of all, he discovered that when he squeezed the sponges over meat, the juices dissolved it.

Thanks to scientists such as Réaumur and Beaumont (and to an unwitting subject, Alexis St. Martin), we now know that chemicals are just as important to digestion as the mashing and churning that had always gotten the credit before.

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Name_____

Protein Digestion

These experiments will give you an inside look at the chemical reactions going on in your body when protein is digested. Remember, the actual processes are more complicated than those in the experiments you will do. Many things are happening all at once inside you that can't be duplicated in your classroom laboratory.

Part I

Equipment

Pencil and paper

2 small glasses or custard cups

Milk

Measuring spoons

Vinegar

Procedure

1. Label the two glasses 1 and 2.
2. Fill glass 1 half full of milk and set aside.
3. Fill glass 2 half full of milk. Add 1 teaspoon of vinegar (a weak acid). Watch what happens. Add another teaspoon of vinegar. Keep adding the vinegar 1 teaspoon at a time until you have 6 teaspoons. Hold the glass up to the light and look at the milk. Put some of the milk in a spoon and examine it more closely. Feel it. Record any changes you notice.

Observations

What happened in glass 2? How did the milk look compared to the milk in glass 1? What caused the difference? Can you make the milk in glass 2 look like the milk in glass 1 by stirring it?

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Part II

Materials and Equipment

Pencil and paper

2 small glasses or custard cups

Hot plate

Measuring cup

Milk

Saucepan

Stirring spoon

Laboratory thermometer (or waterproof thermometer with a range from freezing to boiling)

Rennet or junket tablets

Mortar and pestle (or spoon and plate)

Procedure

1. Label the two glasses 1 and 2.

2. Using the hot plate, warm 1/2 cup milk over low heat in the saucepan, stirring constantly. Check the temperature with a laboratory thermometer. Remove from the heat when the temperature reaches 110 degrees Fahrenheit. While the milk is warming, crush a rennet tablet into a powder, using the mortar and pestle (or the back of a spoon against a plate). Pour the warm milk into glass 1. Stir in *half* of the crushed rennet tablet. (The tablet contains an enzyme called rennin.)

3. Pour 1/2 cup cold milk into glass 2. Stir the other half of the crushed rennet tablet into the cold milk.

4. Set both glasses aside and check back in 15 minutes, then again in half an hour. Record any changes you notice.

Observations

What happened in glass 1? In glass 2? What was the one difference in the way you treated the two glasses of milk? How did this affect what happened?

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Sciences, Cornell University, 1986.

Part III

Materials

Pencil and paper

4 small glasses or custard cups

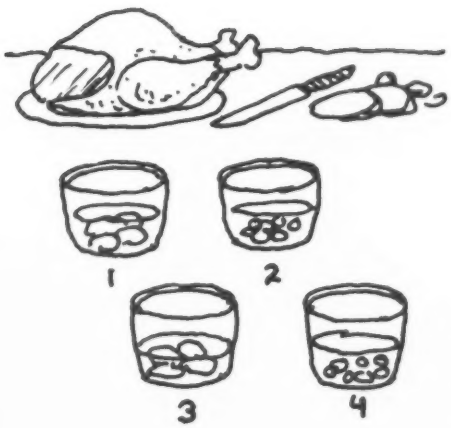
Water

Measuring teaspoon

Powdered meat tenderizer

Knife

Pieces of cooked chicken



Procedure

1. Label the glasses 1 through 4.
2. Fill each glass half full of very warm water.
3. Add 1 teaspoon powdered meat tenderizer (an enzyme that works similarly to enzymes in your digestive tract) to glasses 1 and 2. (Do not add the tenderizer to glasses 3 and 4.)
4. Now put a bite-sized piece of the cooked chicken in glasses 1 and 3.
5. Take two more pieces of chicken and cut them into small bits. Add the bits to glasses 2 and 4.
6. Set all four glasses aside. Check them in half an hour. Stir the chicken around in the water. Feel it with your fingers. Squeeze it gently. Record any differences you notice.

Observations

What happened to the chicken in glasses 1 and 2? How did the chicken look? How did it look and feel compared to the chicken in glasses 3 and 4? If the chicken in each of the glasses looked or felt different, what do you think caused the difference? Why didn't you add any meat tenderizer to glasses 3 and 4?

If You Want to Learn More

Have you ever tried to make a gelatin dessert or salad at home using fresh pineapple? If you have, you were probably disappointed to find that no matter how long you waited, the gelatin wouldn't gel. So you threw it all away and started over. But since you didn't have any more fresh pineapple, you had to use canned pineapple instead. This time the gelatin set.

Why didn't the first gelatin gel? An enzyme in the fresh pineapple "digested" the protein in the gelatin. Heat from the canning process had destroyed the enzyme in the canned pineapple so that it had no effect on the second batch of gelatin.

Try this experiment yourself. Prepare one package of flavored gelatin dessert according to the label directions. Divide the mixture between two glasses. Label one glass "enzyme." Put one tablespoon of powdered meat tenderizer in the "enzyme" glass. (The tenderizer contains papaine, a natural enzyme in pineapple.) Chill both glasses for at least two hours. What happens in each glass?

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Science, Cornell University, 1986.

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Science, Cornell University, 1986.

Name _____

Say Cheese

The story goes that cheese was first discovered by accident when an Arab was crossing the desert. He carried milk in a canteen made from a calf's stomach. When he stopped to drink the milk, he was shocked to discover that it had become lumpy. But since he was tired and hungry, he drank it anyway. He found it so delicious that he is supposed to have exclaimed, "Jeez!" Can you guess what caused his milk to turn into cheese?*

You can try making a simple cheese at home or with a group of friends at school.

Materials

Measuring cup

Milk

Saucepan

Hot plate or stove

Laboratory thermometer (or waterproof thermometer with a range from freezing to boiling)

Rennet tablets

Mortar and pestle

Rubber band to fit around rim of bowl

Cheesecloth

Bowl (at least 1 quart capacity)

Spreading knife

Saltine crackers

Procedure

1. Measure 2 cups of milk into the saucepan. Using the hot plate or stove, heat the milk to 88 degrees Fahrenheit. Check the temperature of the milk with the thermometer. Be sure not to overheat the milk.

2. Crush a rennet tablet with a mortar and pestle and add the powder to the warm milk.

3. Keep the milk warm (about 80 degrees Fahrenheit) until it curdles. This may take 6 to 12 hours.

4. Use the rubber band to attach the cheesecloth over the rim of a bowl. Pour the curds and whey from the saucepan into the cheesecloth. The curds will collect in the cheesecloth, and the whey will drain into the bowl.

5. Wrap the curds tightly in the cheesecloth and squeeze out the rest of the whey.

6. Your cheese is ready. Try some on a saltine cracker.

Observations

How does the cheese taste? Is it like the cheese you are used to eating? Can you find out why it doesn't taste as sharp as cheddar or feel as smooth as mozzarella? What do commercial cheesemakers do with cheese after they curdle it?

*Answer: The calf's stomach probably still contained some of the enzyme rennin. The action of the rennin on the milk while it jostled around in the canteen in the hot desert sun turned the milk to a crude form of cheese.

Nutrition Comes Alive, Level 5, The Nutrient Connection. Developed by the Division of Nutritional Science, Cornell University, 1986.

An Extension Publication of the Division of Nutritional Sciences, a division of the New York State College of Agriculture and Life Sciences and the New York State College of Human Ecology, statutory colleges of the State University, Cornell University, Ithaca, New York.

1980 Edition published pursuant to a contract with the New York State Education Department with funding from USDA, Food and Nutrition Service. Nutrition Education and Training Program.

1986 Revised Edition published pursuant to a contract with the New York State Health Department.

This publication is issued to further Cooperative Extension work mandated by acts of Congress May 8 and June 30, 1914. It was produced with the cooperation of the U.S. Department of Agriculture, Cornell Cooperative Extension, New York State College of Agriculture and Life Sciences, New York State College of Human Ecology, and New York State College of Veterinary Medicine, at Cornell University. Cornell Cooperative Extension offers equal program and employment opportunities. Lucinda A. Noble, Director.